MAX-306M1 Series

Models: MAX-306M1 (2.5 GHz) and MAX-316M1 (3.5 GHz)

User's Guide

WiMAX MIMO Outdoor Simple CPE

Default Login Details

IP Address:	http://192.168.1.1
User Name:	admin
Password:	1234

Firmware Version 3.70
Edition 1, 12/2009

www.zyxel.com

ZyXEL

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About This User's Guide

Intended Audience

This manual is intended for people who want to configure the ZyXEL WiMAX Modem using the web configurator. You should have at least a basic knowledge of TCP/IP networking concepts and topology.

Note: This book covers the following models: MAX-306M1 and MAX-316M1.

Related Documentation

- Quick Start Guide

  The Quick Start Guide is designed to help you get up and running right away. It contains information on setting up your network and configuring for Internet access.

- Web Configurator Online Help

  Embedded web help for descriptions of individual screens and supplementary information.

- Support Disc

  Refer to the included CD for support documents.

- ZyXEL Web Site

  Please refer to www.zyxel.com for additional support documentation and product certifications.

User's Guide Feedback

Help us help you. Send all User's Guide-related comments, questions or suggestions for improvement to the following address, or use e-mail instead. Thank you!

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Document Conventions

Warnings and Notes

These are how warnings and notes are shown in this User's Guide.

Warnings tell you about things that could harm you or your WiMAX Modem.

Note: Notes tell you other important information (for example, other things you may need to configure or helpful tips) or recommendations.

Syntax Conventions

- The product(s) described in this book may be referred to as the "WiMAX Modem", the "device", the "system" or the "product" in this User's Guide.
- Product labels, screen names, field labels and field choices are all in **bold** font.
- A key stroke is denoted by square brackets and uppercase text, for example, [ENTER] means the "enter" or "return" key on your keyboard.
- "Enter" means for you to type one or more characters and then press the [ENTER] key. "Select" or "choose" means for you to use one of the predefined choices.
- A right angle bracket (>) within a screen name denotes a mouse click. For example, **TOOLS > Logs > Log Settings** means you first click **Tools** in the navigation panel, then the **Logs** sub menu and finally the **Log Settings** tab to get to that screen.
- Units of measurement may denote the "metric" value or the "scientific" value. For example, "k" for kilo may denote "1000" or "1024", "M" for mega may denote "1000000" or "1048576" and so on.
- "e.g.," is a shorthand for "for instance", and "i.e.," means "that is" or "in other words".

Icons Used in Figures

Figures in this User's Guide may use the following generic icons. The WiMAX Modem icon is not an exact representation of your WiMAX Modem.\

Table 1 Common Icons

WiMAX Access Point	Computer	Wireless Signal
Notebook	Server	WiMAX Base Station
Telephone	Switch	Router
Internet Cloud	Internet/WiMAX Cloud	

Safety Warnings

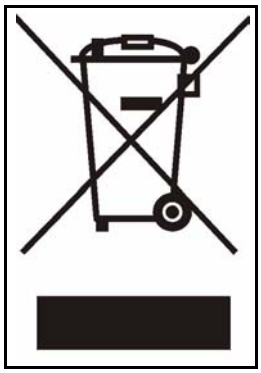
For your safety, be sure to read and follow all warning notices and instructions.

- Do NOT use this product near water, for example, in a wet basement or near a swimming pool.
- Do NOT expose your device to dampness, dust or corrosive liquids.
- Do NOT store things on the device.
- Do NOT install, use, or service this device during a thunderstorm. There is a remote risk of electric shock from lightning.
- Connect ONLY suitable accessories to the device.
- Do NOT open the device or unit. Opening or removing covers can expose you to dangerous high voltage points or other risks. ONLY qualified service personnel should service or disassemble this device. Please contact your vendor for further information.
- Make sure to connect the cables to the correct ports.
- Place connecting cables carefully so that no one will step on them or stumble over them.
- Always disconnect all cables from this device before servicing or disassembling.
- Use ONLY an appropriate power adaptor or cord for your device. Connect it to the right supply voltage (for example, 110V AC in North America or 230V AC in Europe).
- Do NOT remove the plug and connect it to a power outlet by itself; always attach the plug to the power adaptor first before connecting it to a power outlet.
- Do NOT allow anything to rest on the power adaptor or cord and do NOT place the product where anyone can walk on the power adaptor or cord.
- Do NOT use the device if the power adaptor or cord is damaged as it might cause electrocution.
- If the power adaptor or cord is damaged, remove it from the device and the power source.
- Do NOT attempt to repair the power adaptor or cord. Contact your local vendor to order a new one.Do not use the device outside, and make sure all the connections are indoors. There is a remote risk of electric shock from lightning.
- Do NOT obstruct the device ventilation slots, as insufficient airflow may harm your device.Use only No. 26 AWG (American Wire Gauge) or larger telecommunication line cord.
- Antenna Warning! This device meets ETSI and FCC certification requirements when using the included antenna(s). Only use the included antenna(s).
- If you wall mount your device, make sure that no electrical lines, gas or water pipes will be damaged.

- Make sure that the cable system is grounded so as to provide some protection against voltage surges.

Your product is marked with this symbol, which is known as the WEEE mark.

WEEE stands for Waste Electronics and Electrical Equipment. It means that used electrical and electronic products should not be mixed with general waste. Used electrical and electronic equipment should be treated separately.



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PART I
Introduction and Wizards

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1 Getting Started

1.1 About Your WiMAX Modem

The WiMAX Modem allows you to access the Internet by connecting to a WiMAX wireless network. You can use a traditional analog telephone to make Internet calls using the WiMAX Modem's Voice over IP (VoIP) communication capabilities.

You can configure firewall and content filtering as well as a host of other features.

The web browser-based Graphical User Interface (GUI), also known as the web configurator, provides easy management.

See Chapter 23 on page 257 for a complete list of features for your model.

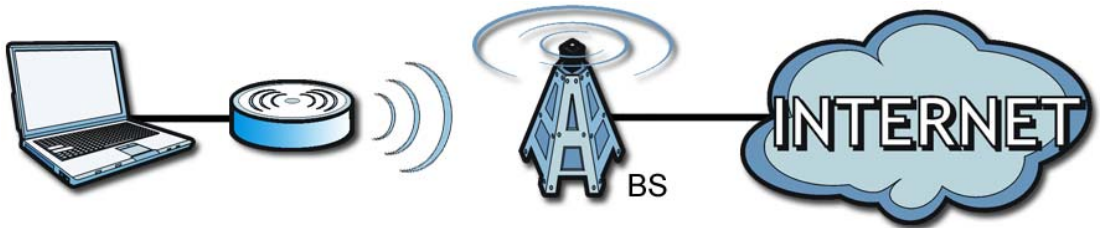
1.1.1 WiMAX Internet Access

Connect your computer or network to the WiMAX Modem for WiMAX Internet access. See the Quick Start Guide for instructions on hardware connection.

In a wireless metropolitan area network (MAN), the WiMAX Modem connects to a WiMAX base station (BS) for Internet access.

The following diagram shows a notebook computer equipped with the WiMAX Modem connecting to the Internet through a WiMAX base station (marked **BS**).

Figure 1 Mobile Station and Base Station



When the firewall is on, all incoming traffic from the Internet to your network is blocked unless it is initiated from your network.

Use content filtering to block access to web sites with URLs containing keywords that you specify. You can define time periods and days during which content filtering is enabled and include or exclude particular computers on your network from content filtering. For example, you could block access to certain web sites for the kids.

1.1.2 Make Calls via Internet Telephony Service Provider

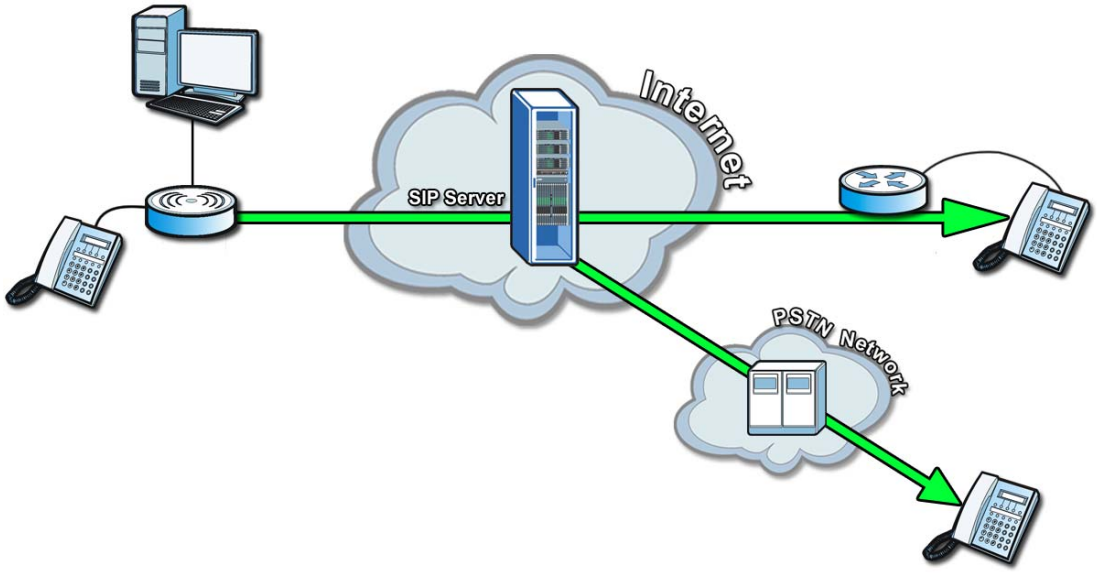
In a home or small office environment, you can use the WiMAX Modem to make and receive the following types of VoIP telephone calls:

- Peer-to-Peer calls - Use the WiMAX Modem to make a call directly to the recipient's IP address without using a SIP proxy server.

Figure 2 WiMAX Modem's VoIP Features - Peer-to-Peer Calls

- Calls via a VoIP service provider - The WiMAX Modem sends your call to a VoIP service provider's SIP server which forwards your calls to either VoIP or PSTN phones.

Figure 3 WiMAX Modem's VoIP Features - Calls via VoIP Service Provider



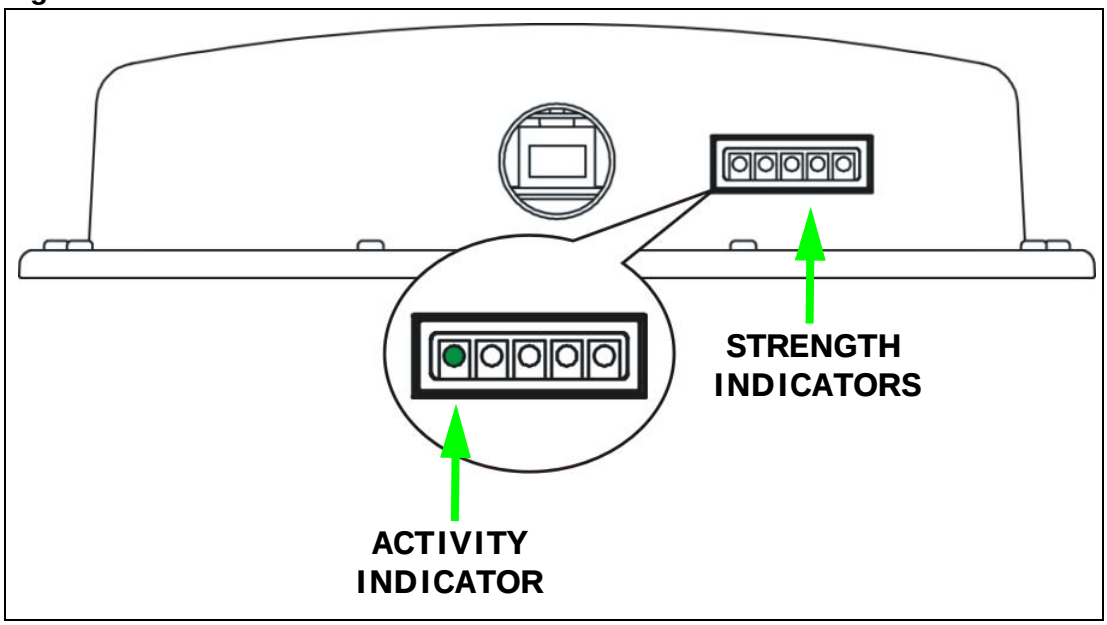
1.2 WiMAX Modem Hardware

Follow the instructions in the Quick Start Guide to make hardware connections.

1.2.1 LEDs

The following figure shows the LEDs (lights) on the WiMAX Modem.

Figure 4 The WiMAX Modem's LEDs



The following table describes your WiMAX Modem's LEDs (from right to left).

Table 2 The WiMAX Modem

LED	STATE	DESCRIPTION
Power (IDU only)	Off	The WiMAX Modem is not receiving power.
	Green	The WiMAX Modem is receiving power and functioning correctly.
Strength Indicator	The Strength Indicator LEDs display the Received Signal Strength Indication (RSSI) of the wireless (WiMAX) connection.	
	5 Signal LEDs	The signal strength is greater than or equal to -59.
	4 Signal LEDs	The signal strength is between -69 and -60
	3 Signal LEDs	The signal strength is between -79 dBm and -70.
	2 Signal LEDs	The signal strength is between -89 and -80 dBm.
	1 Signal LED	The signal strength is between -90 and -95 dBm.
	0 Signal LEDs	There is no WiMAX connection.

Table 2 The WiMAX Modem

LED	STATE	DESCRIPTION
Activity Indicator	Off	The WiMAX Modem is not ready.
	Green	The WiMAX Modem is connected to the network.
	Blinking	The WiMAX Modem system is booting up or the WiMAX Modem is seeking a viable signal.

1.3 Good Habits for Managing the Device

Do the following things regularly to make the WiMAX Modem more secure and to manage the WiMAX Modem more effectively.

- Change the password. Use a password that's not easy to guess and that consists of different types of characters, such as numbers and letters.
- Write down the password and put it in a safe place.
- Back up the configuration (and make sure you know how to restore it). Restoring an earlier working configuration may be useful if the WiMAX Modem becomes unstable or even crashes. If you forget your password, you will have to reset the WiMAX Modem to its factory default settings. If you backed up an earlier configuration file, you would not have to totally re-configure the WiMAX Modem. You could simply restore your last configuration.

2

Introducing the Web Configurator

2.1 Overview

The web configurator is an HTML-based management interface that allows easy device set up and management via any web browser that supports: HTML 4.0, CSS 2.0, and JavaScript 1.5, and higher. The recommended screen resolution for using the web configurator is 1024 by 768 pixels and 16-bit color, or higher.

In order to use the web configurator you need to allow:

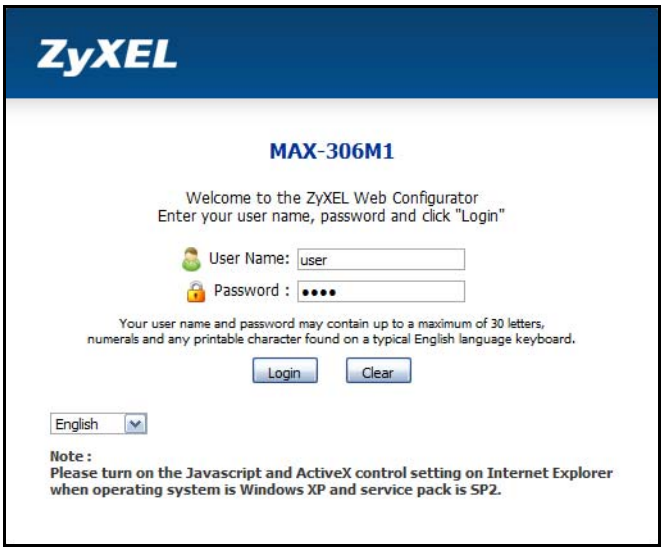
- Web browser pop-up windows from your device. Web pop-up blocking is enabled by default in many operating systems and web browsers.
- JavaScript (enabled by default in most web browsers).
- Java permissions (enabled by default in most web browsers).

See the Appendix C on page 299 for more information on configuring your web browser.

2.1.1 Accessing the Web Configurator

1. Make sure your WiMAX Modem hardware is properly connected (refer to the Quick Start Guide for more information).
2. Launch your web browser.
3. Enter "192.168.1.1" as the URL.

4 A password screen displays. The default password (“1234”) displays in non-readable characters. If you haven’t changed the password yet, you can just click **Login**. Click **Cancel** to revert to the default password in the password field. If you have changed the password, enter your password and click **Login**.


ZyXEL
MAX-306M1
Welcome to the ZyXEL Web Configurator
Enter your user name, password and click "Login"
User Name: user
Password : ••••
Your user name and password may contain up to a maximum of 30 letters, numerals and any printable character found on a typical English language keyboard.
Login
Clear
English
Note :
Please turn on the Javascript and ActiveX control setting on Internet Explorer when operating system is Windows XP and service pack is SP2.

5 The following screen displays if you have not yet changed your password. It is highly recommended you change the default password. Enter a new password, retype it to confirm and click **Apply**; alternatively click **Ignore** to proceed to the main menu if you do not want to change the password now.

ZyXEL
MAX-306M1
Enter a New Password
Your device is currently using the factory default password. To protect your network from unauthorized access, you should change your password at this time. Select a new password that is easy for you to remember yet difficult for would-be intruders to guess. We suggest that you combine text with numbers to make it even more difficult to crack. Your new password may contain up to a maximum of 30 letters, numerals and any printable character found on a typical English language keyboard.
New Password:
Confirm Password:
(max. 30 alphanumeric, printable characters and no spaces)
Apply
Ignore

6 A screen displays to let you choose to go to the Wizard or the Advanced screens.

- Click **Go to Wizard setup** if you are logging in for the first time or if you want to make basic changes. The wizard selection screen appears after you click it. See Chapter 3 on page 41 for more information.
- Click **Go to Advanced setup** if you want to configure features that are not available in the wizards. The main screen appears after you click it. See Chapter 6 on page 65 for more information

ZyXEL
MAX-306M1
Select a Mode
Use the ZyXEL Setup Wizard to quickly and easily configure your Internet connection or VoIP account server settings. If this is your first time using the web configurator, we suggest that you use this mode.
Use the Advanced mode if you want to configure all possible settings for your device.
Go to Wizard setup
Go to Advanced setup

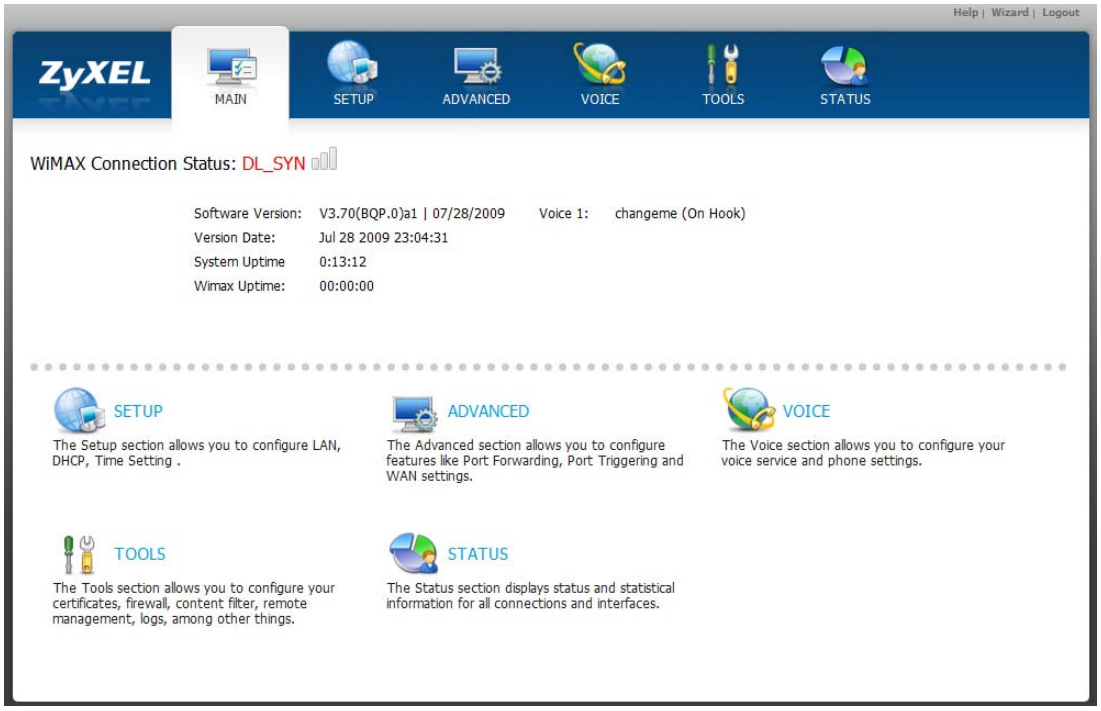
Note: For security reasons, the WiMAX Modem automatically logs you out if you do not use the Web Configurator for five minutes. If this happens, log in again.

2.2 The Main Screen

When you first log into the web configurator and by-pass the wizard, the Main screen appears. Here you can view a summary of your WiMAX Modem connection status. This is also the default “home” page for the ZyXEL web configurator and it contains conveniently-placed shortcuts to all of the other screens.

Note: Some features in the web configurator may not be available depending on your firmware version and/or configuration.

Figure 5 Main Screen


Help | Wizard | Logout
ZyXEL
MAIN
SETUP
ADVANCED
VOICE
TOOLS
STATUS
WiMAX Connection Status: DL_SYN
Software Version: V3.70(BQP.0)a1 | 07/28/2009
Voice 1: changeme (On Hook)
Version Date: Jul 28 2009 23:04:31
System Uptime 0:13:12
Wimax Uptime: 00:00:00
SETUP
The Setup section allows you to configure LAN, DHCP, Time Setting .
ADVANCED
The Advanced section allows you to configure features like Port Forwarding, Port Triggering and WAN settings.
VOICE
The Voice section allows you to configure your voice service and phone settings.
TOOLS
The Tools section allows you to configure your certificates, firewall, content filter, remote management, logs, among other things.
STATUS
The Status section displays status and statistical information for all connections and interfaces.

The following table describes the icons in this screen.

Table 3 Main > Icons

ICON	DESCRIPTION
	MAIN Click to return to the Main screen.
	SETUP Click to go the Setup screen, where you can configure LAN, DHCP and SNTP settings.
	ADVANCED Click to go to the Advanced screen, where you can configure features like Port Forwarding and Triggering, WAN settings and so on.

Table 3 Main > Icons (continued)

ICON	DESCRIPTION
	VOICE Click to go to the Voice screen, where you can configure your voice service and phone settings.
	TOOLS Click to go the Tools screen, where you can configure your firewall, QoS, and content filter, among other things.
	STATUS Click to go to the Status screen, where you can view status and statistical information for all connections and interfaces.
	Strength Indicator Displays a visual representation of the quality of your WiMAX connection. • Disconnected - Zero bars • **Poor** reception - One bar • **Good** reception - Two bars • **Excellent** reception - Three bars

The following table describes the labels in this screen.

Table 4 Main

LABEL	DESCRIPTION
Help	Click to open the web configurator's online help.
Wizard	Click to run the Internet Connection and VoIP Connection Setup Wizard. All of the settings that you can configure in this wizard are also available in these web configurator screens.
Logout	Click to log out of the web configurator. Note: This does not log you off the WiMAX network, it simply logs you out of the WiMAX Modem's browser-based configuration interface.
WiMAX Connection Status	This field indicates the current status of your WiMAX connection. Status messages are as follows: • **Connected** - Indicates that the WiMAX Modem is connected to the WiMAX network. Use the **Strength Indicator** icon to determine the quality of your network connection. • **Disconnected** - Indicates that the WiMAX Modem is not connected to the WiMAX network. • **DL_SYN** - Indicates a download synchronization is in progress. This means the firmware is checking with the server for any updates or settings alterations.

Table 4 Main (continued)

LABEL	DESCRIPTION
Software Version	This field indicates the version number of the WiMAX Modem's firmware. The version number takes the form of: *Version(Build),release status (candidate)* | *Version Release Date*. For example: V3.70(BCC.0)c4 | 07/08/2009 indicates that the firmware is 3.70, build BCC.0, candidate 4, released on July 08, 2009.
Version Date	This field indicates the exact date and time the current firmware was compiled.
System Uptime	This field indicates how long the WiMAX Modem has been on. This resets every time you shut the device down or restart it.
WiMAX Uptime	This field indicates how long the WiMAX Modem has been connected to the WiMAX network. This resets every time you disconnect from the WiMAX network, shut the device down, or restart it.
Voice	This field indicates the number and receiver status of a voice account configured on this device.

3

Internet Connection Wizard

3.1 Overview

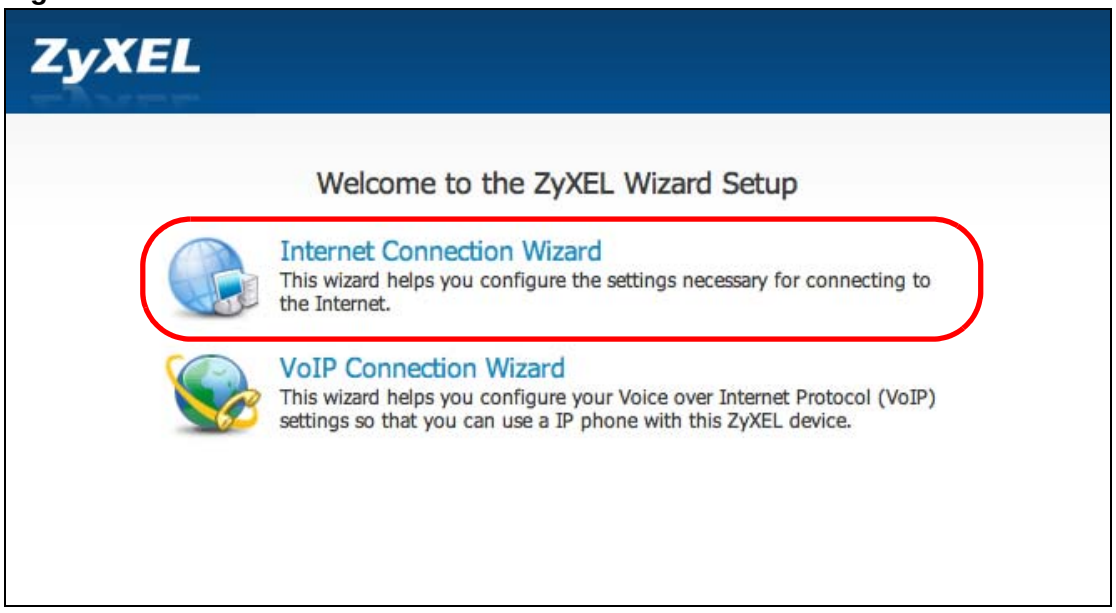
This chapter provides information on the ZyXEL Setup Wizard screens. The wizard guides you through several steps where you can configure your Internet and VoIP settings.

3.1.1 Welcome to the ZyXEL Setup Wizard

This is the welcome screen for the ZyXEL Setup Wizard. You can choose to either configure your Internet connection or your VoIP connection.

The Internet Connection Wizard screens are described in detail in the following sections.

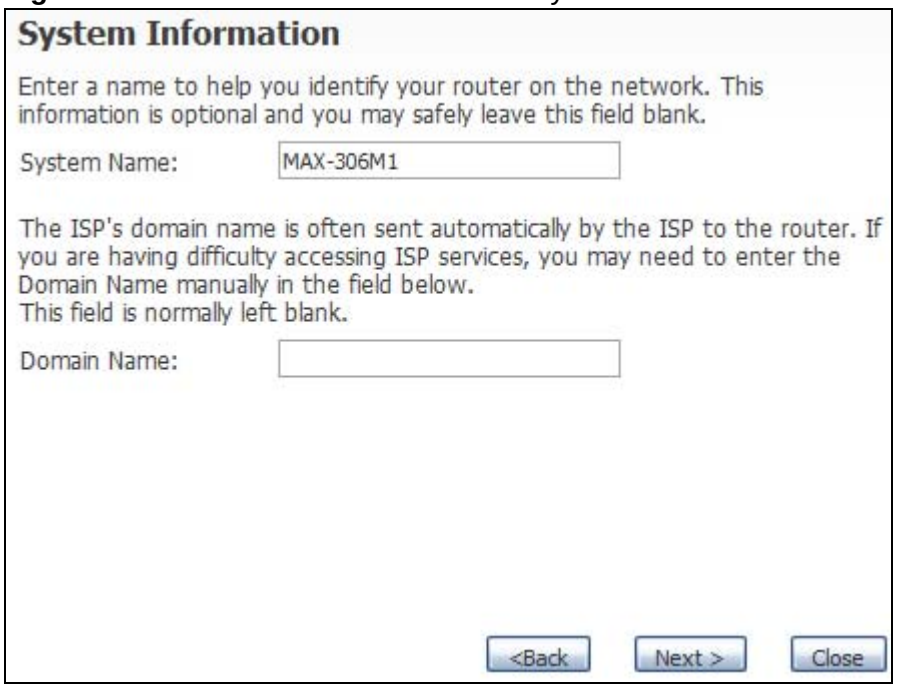
Figure 6 Select a Mode


ZyXEL
Welcome to the ZyXEL Wizard Setup
Internet Connection Wizard
This wizard helps you configure the settings necessary for connecting to the Internet.
VoIP Connection Wizard
This wizard helps you configure your Voice over Internet Protocol (VoIP) settings so that you can use a IP phone with this ZyXEL device.

3.1.2 System Information

This Internet Connection Wizard screen allows you to configure your WiMAX Modem's system information. The settings here correspond to the **ADVANCED > System Configuration > General** screen (see Section 11.2 on page 121 for more).

Figure 7 Internet Connection Wizard > System Information


System Information
Enter a name to help you identify your router on the network. This information is optional and you may safely leave this field blank.
System Name:
MAX-306M1
The ISP's domain name is often sent automatically by the ISP to the router. If you are having difficulty accessing ISP services, you may need to enter the Domain Name manually in the field below.
This field is normally left blank.
Domain Name:
<Back
Next >
Close

The following table describes the labels in this screen.

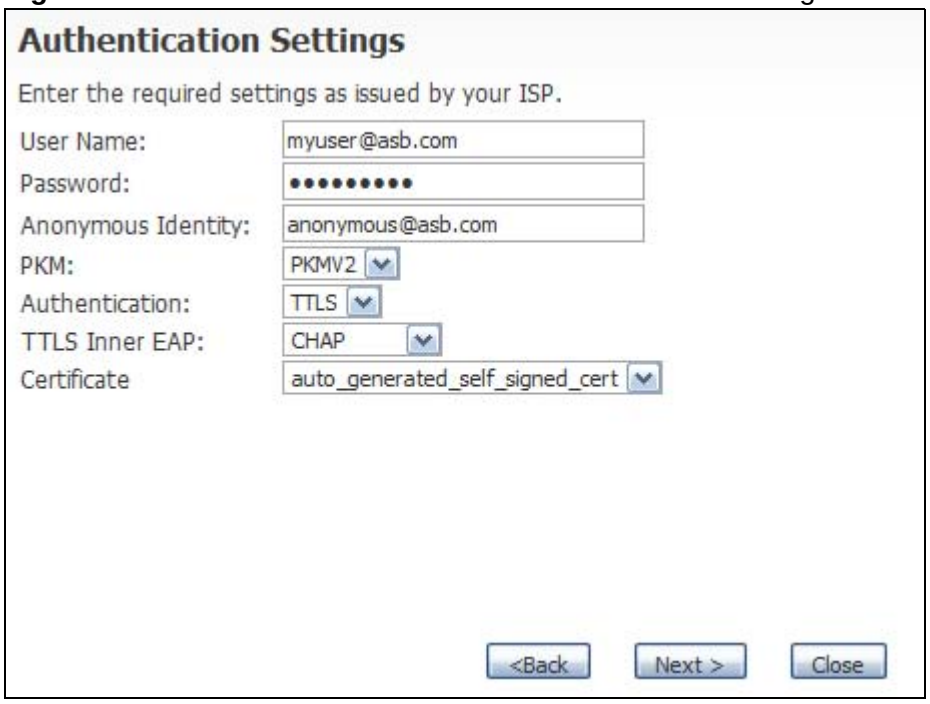
Table 5 Internet Connection Wizard > System Information

LABEL	DESCRIPTION
System Name	System Name is a unique name to identify the WiMAX Modem in an Ethernet network. Enter a descriptive name. This name can be up to 30 alphanumeric characters long. Spaces are not allowed, but dashes "-" and underscores "_" are accepted.
Domain Name	Type the domain name (if you know it) here. If you leave this field blank, the ISP may assign a domain name via DHCP. The domain name entered by you is given priority over the ISP assigned domain name.
Back	Click to display the previous screen.
Next	Click to proceed to the next screen.
Close	Click to close the wizard without saving.

3.1.3 Authentication Settings

This Internet Connection Wizard screen allows you to configure your Internet access settings. The settings here correspond to the **ADVANCED > WAN Configuration > Internet Connection** screen (see Section 8.2 on page 88 for more information).

Figure 8 Internet Connection Wizard > Authentication Settings Screen



The following table describes the labels in this screen.

Table 6 Internet Connection Wizard > Authentication Settings Screen

LABEL	DESCRIPTION
Authentication	
User Name	Use this field to enter the username associated with your Internet access account. You can enter up to 61 printable ASCII characters.
Password	Use this field to enter the password associated with your Internet access account. You can enter up to 47 printable ASCII characters.

Table 6 Internet Connection Wizard > Authentication Settings Screen (continued)

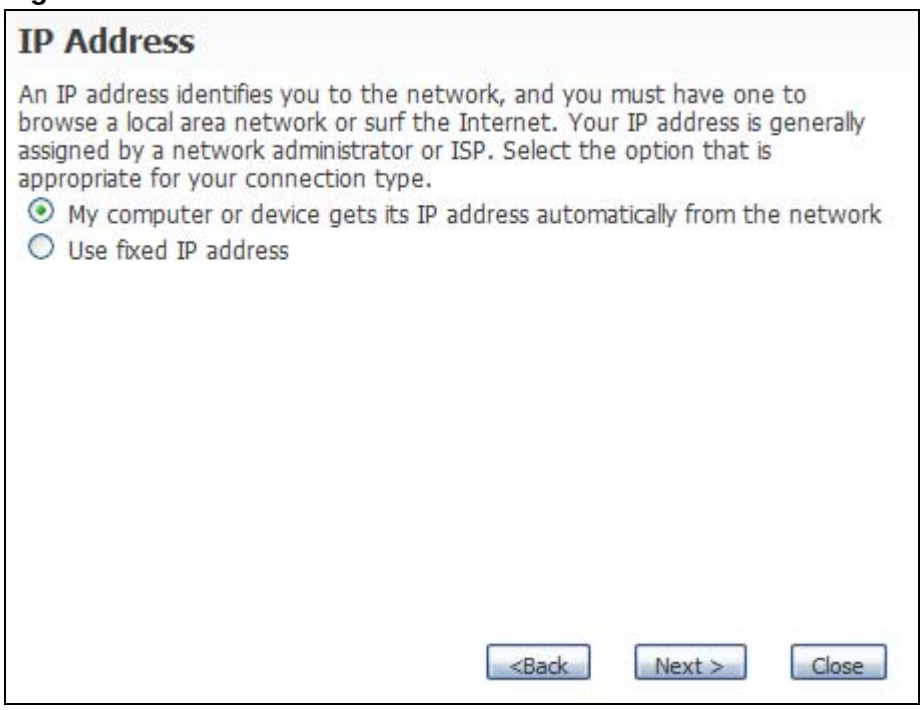
LABEL	DESCRIPTION
Anonymous Identity	Enter the anonymous identity provided by your Internet Service Provider. Anonymous identity (also known as outer identity) is used with EAP-TTLS encryption. The anonymous identity is used to route your authentication request to the correct authentication server, and does not reveal your real user name. Your real user name and password are encrypted in the TLS tunnel, and only the anonymous identity can be seen. Leave this field blank if your ISP did not give you an anonymous identity to use.
PKM	This field displays the Privacy Key Management version number. PKM provides security between the WiMAX Modem and the base station. At the time of writing, the WiMAX Modem supports PKMv2 only. See the WiMAX security appendix for more information.
Authentication	This field displays the user authentication method. Authentication is the process of confirming the identity of a mobile station (by means of a username and password, for example). Check with your service provider if you are unsure of the correct setting for your account. Choose from the following user authentication methods: • **TTLS** (Tunnelled Transport Layer Security) • **TLS** (Transport Layer Security) Note: Not all WiMAX Modems support TLS authentication. Check with your service provider for details.
TTLS Inner EAP	This field displays the type of secondary authentication method. Once a secure EAP-TTLS connection is established, the inner EAP is the protocol used to exchange security information between the mobile station, the base station and the AAA server to authenticate the mobile station. See the WiMAX security appendix for more details. The WiMAX Modem supports the following inner authentication types: • **CHAP** (Challenge Handshake Authentication Protocol) • **MSCHAP** (Microsoft CHAP) • **MSCHAPV2** (Microsoft CHAP version 2) • **PAP** (Password Authentication Protocol)
Certificate	This is the security certificate the WiMAX Modem uses to authenticate the AAA server. Use the **TOOLS > Certificates > Trusted CA** screen to import certificates to the WiMAX Modem.
Back	Click to display the previous screen.
Next	Click to proceed to the next screen.
Close	Click to close the wizard without saving.

3.1.4 IP Address

This Internet Connection Wizard screen allows you to configure your IP address. The settings here correspond to the **SETUP > Set IP Address** screen (see Section 6.2 on page 66).

A fixed IP address is a static IP that your ISP gives you. An automatic (dynamic) IP address is not fixed; the ISP assigns you a different one each time you connect to the Internet.

Figure 9 Internet Connection Wizard > IP Address


IP Address
An IP address identifies you to the network, and you must have one to browse a local area network or surf the Internet. Your IP address is generally assigned by a network administrator or ISP. Select the option that is appropriate for your connection type.
My computer or device gets its IP address automatically from the network
Use fixed IP address
<Back
Next >
Close

The following table describes the labels in this screen.

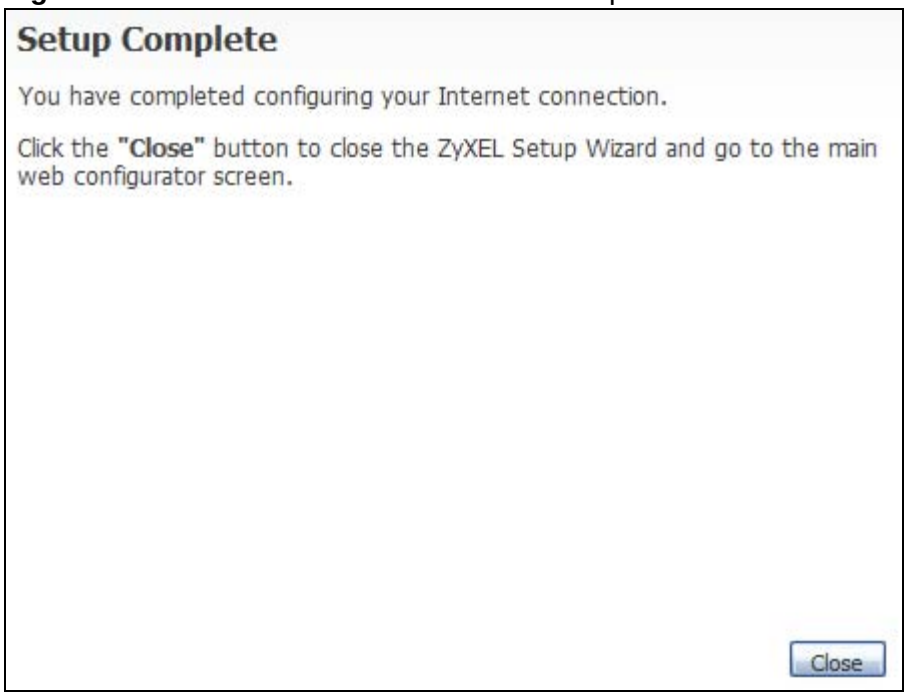
Table 7 Internet Connection Wizard > IP Address

LABEL	DESCRIPTION
IP Address	
My computer or device gets its IP address automatically from the network (Default)	Select this if you have a dynamic IP address. A dynamic IP address is not fixed; the ISP assigns you a different one each time you connect to the Internet.
Use Fixed IP Address	A static IP address is a fixed IP that your ISP gives you.
Back	Click to display the previous screen.
Next	Click to proceed to the next screen.
Close	Click to close the wizard screen without saving.

3.1.5 Setup Complete

Click **Close** to complete and save the Internet Connection Wizard settings.

Figure 10 Internet Connection Wizard > Complete


Setup Complete
You have completed configuring your Internet connection.
Click the "Close" button to close the ZyXEL Setup Wizard and go to the main web configurator screen.
Close

Launch your web browser and navigate to www.zyxel.com. If everything was configured properly, the web page should display. You can now surf the Internet!

Refer to the rest of this guide for more detailed information on the complete range of WiMAX Modem features available in the more advanced web configurator.

Note: If you cannot access the Internet, open the web configurator again to confirm that the Internet settings you configured in the wizard setup are correct.

4

VoIP Connection Wizard

4.1 Overview

This chapter shows you how to use the wizard to set up your voice account(s).

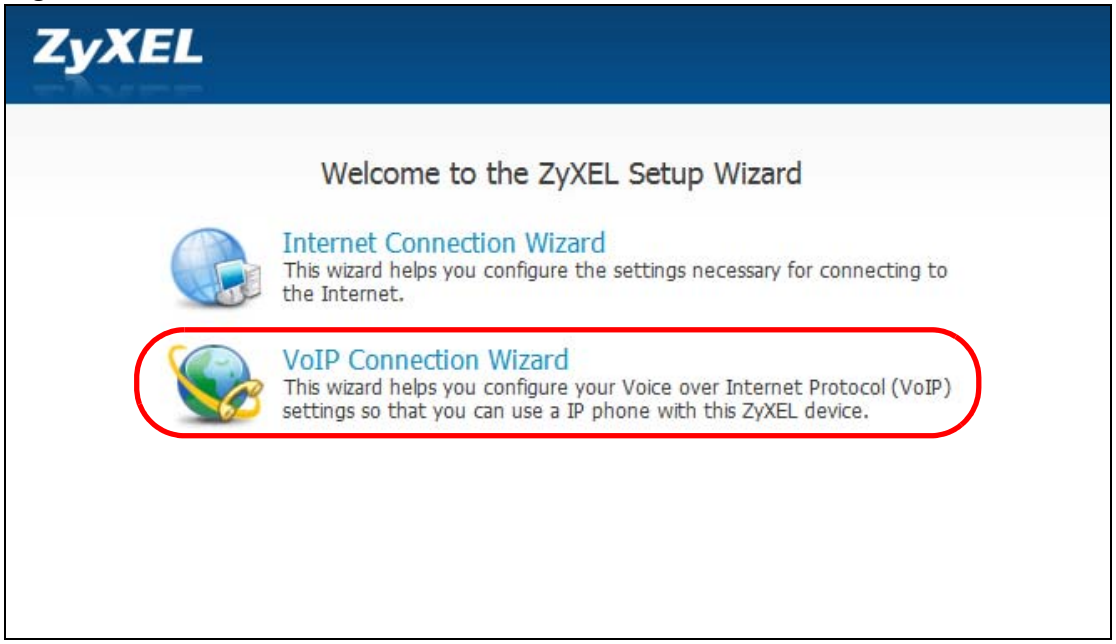
The WiMAX Modem has Voice over IP (VoIP) communication capabilities that allow you to use a traditional analog telephone to make Internet calls. You can configure the WiMAX Modem to use up to two SIP based VoIP accounts.

4.2 Welcome to the ZyXEL Setup Wizard

This is the welcome screen for the ZyXEL Setup Wizard. You can choose to either configure your Internet connection or your VoIP connection.

The VoIP Connection Wizard screens are described in detail in the following sections.

Figure 11 Select a Mode


ZyXEL
Welcome to the ZyXEL Setup Wizard
Internet Connection Wizard
This wizard helps you configure the settings necessary for connecting to the Internet.
VoIP Connection Wizard
This wizard helps you configure your Voice over Internet Protocol (VoIP) settings so that you can use a IP phone with this ZyXEL device.

4.2.1 First Voice Account Settings

This VoIP Connection Wizard screen allows you to configure your voice account. The settings here correspond to the **VOICE > Service Configuration > SIP Setting** screen (see Section 12.2 on page 133 for more information).

Figure 12 VoIP Connection > First Voice Account Settings

The following table describes the labels in this screen

Table 8 VoIP Connection > First Voice Account Settings

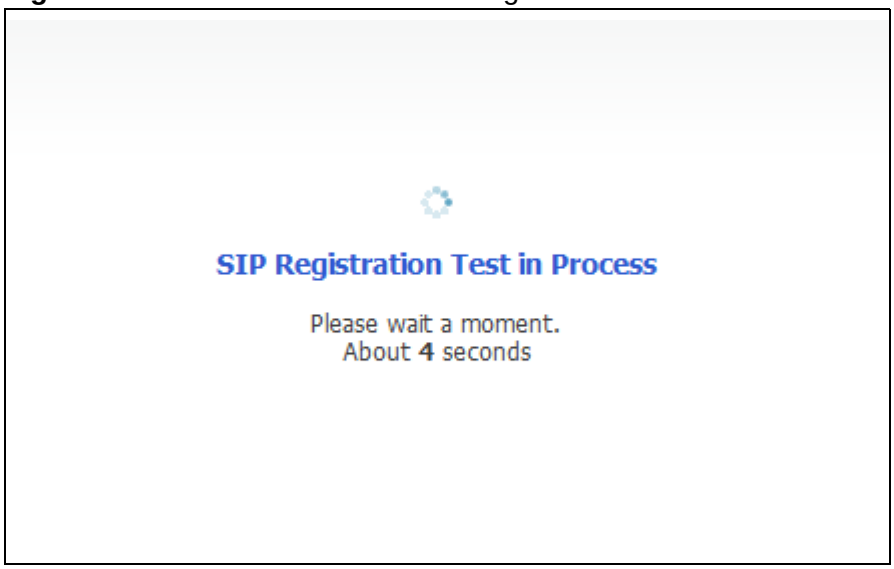
LABEL	DESCRIPTION
SIP Number	Enter your SIP number in this field (use the number or text that comes before the @ symbol in a SIP account like 1234@VoIP-provider.com). You can use up to 127 ASCII characters.
SIP Server Address	Type the IP address or domain name of the SIP server in this field. It doesn't matter whether the SIP server is a proxy, redirect or register server. You can use up to 95 ASCII characters.
SIP Service Domain	Enter the SIP service domain name in this field (the domain name that comes after the @ symbol in a SIP account like 1234@VoIP-provider.com). You can use up to 127 ASCII Extended set characters.
User Name	This is the user name for registering this SIP account with the SIP register server. Type the user name exactly as it was given to you. You can use up to 95 ASCII characters.
Password	Type the password associated with the user name above. You can use up to 95 ASCII Extended set characters.
Back	Click to return to the previous screen.

Table 8 VoIP Connection > First Voice Account Settings (continued)

LABEL	DESCRIPTION
Apply	Click to complete the wizard setup and save your configuration.
Close	Click to close the wizard without saving your settings.

After you enter your voice account settings and click **Apply**, the WiMAX Modem attempts to register your SIP account with the SIP server.

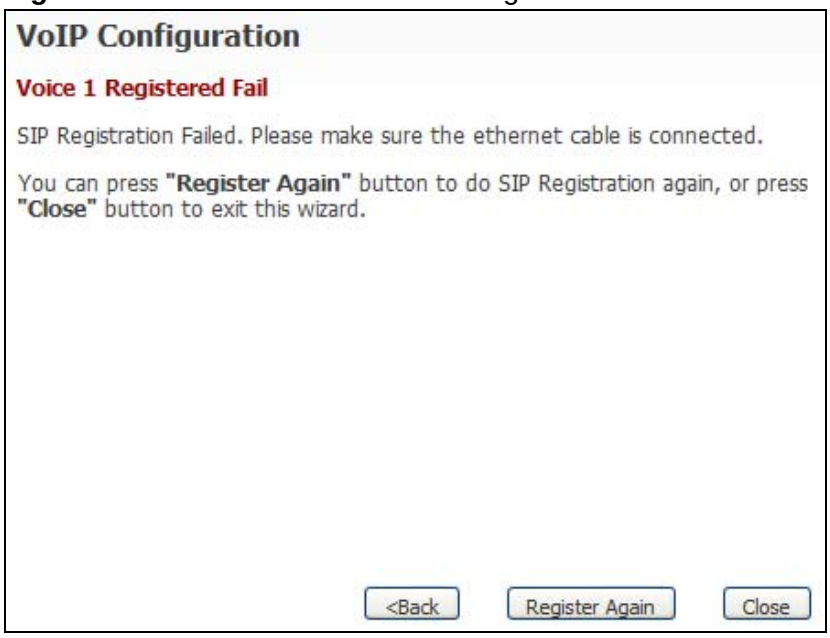
Figure 13 VoIP Connection > SIP Registration Test



This screen displays if SIP account registration fails. Check your WiMAX connection using the **WiMAX Link** and **Strength Indicator** LEDs on the front of the WiMAX Modem, then wait a few seconds and click **Register Again**. If your

Internet connection was already working, you can click **Back** and try re-entering your SIP account settings.

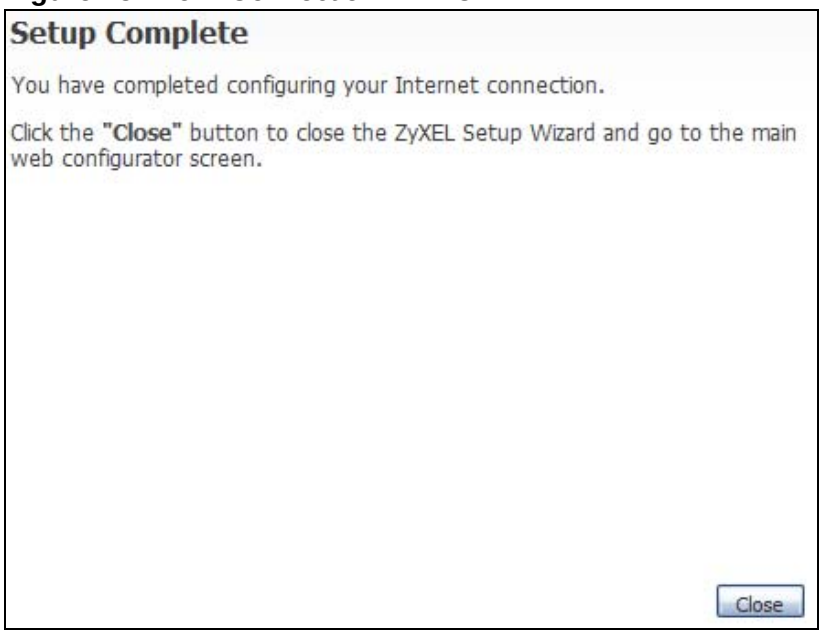
Figure 14 VoIP Connection > SIP Registration Fail


VoIP Configuration
Voice 1 Registered Fail
SIP Registration Failed. Please make sure the ethernet cable is connected.
You can press "Register Again" button to do SIP Registration again, or press "Close" button to exit this wizard.
<Back
Register Again
Close

4.2.2 Setup Complete

Click **Close** to complete and save the VoIP Connection settings.

Figure 15 VoIP Connection > Finish


Setup Complete
You have completed configuring your Internet connection.
Click the "Close" button to close the ZyXEL Setup Wizard and go to the main web configurator screen.
Close

This screen displays if your SIP account registration was successful.

5

Tutorials

5.1 Overview

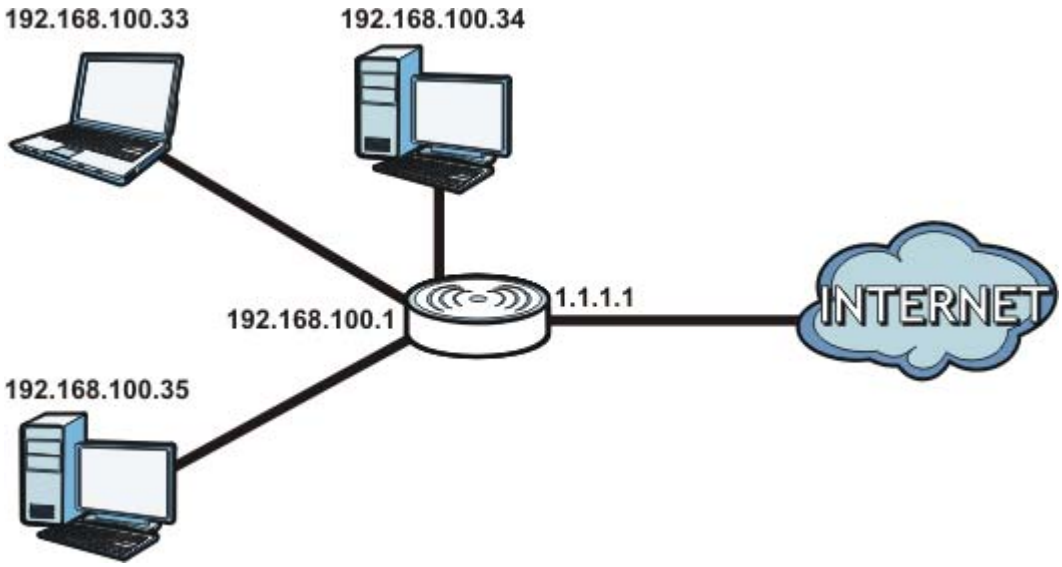
This chapter shows you how to configure some of the WiMAX Modem's features.

Note: Be sure to read Introducing the Web Configurator on page 35 before working through the tutorials presented here. For field descriptions of individual screens, see the related technical reference in this User's Guide.

5.2 Setting Up a Small Network

This tutorial shows you how to set up a small network in your office or home.

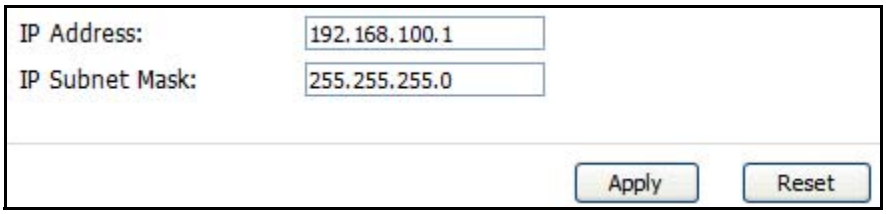
Goal: Connect three computers to your WiMAX Modem to form a small network.



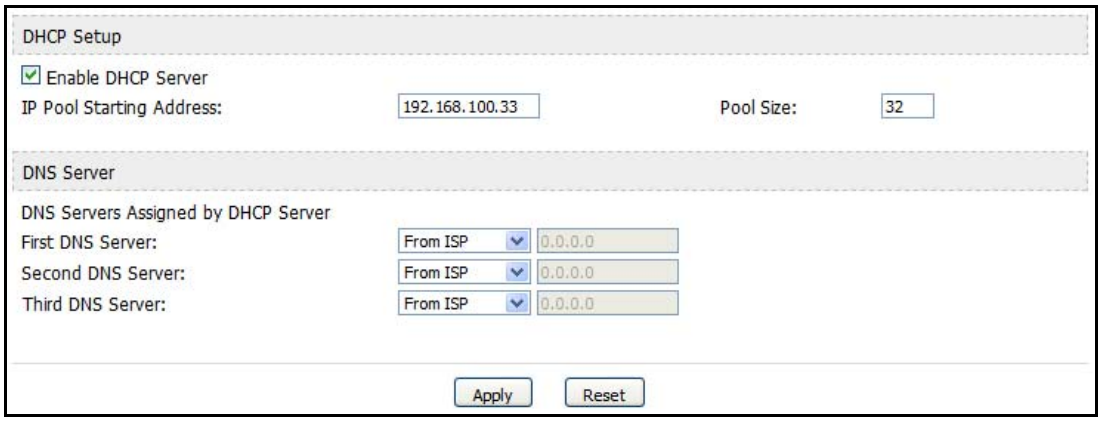
Required: The following table provides a summary of the information you will need to complete the tasks in this tutorial.

INFORMATION	VALUE	SEE ALSO
LAN IP Address	192.168.100.1	Chapter 6 on page 65
Starting IP Address	192.168.100.33	Chapter 7 on page 73
Pool Size	32	
DNS Servers	From ISP	

1 In the Web Configurator, open the **SETUP > Set IP Address** screen and set the IP Address to 192.168.100.1. Use the default **IP Subnet Mask** of 255.255.255.0.



2 Open the **ADVANCED > LAN Configuration > DHCP Setup** screen.

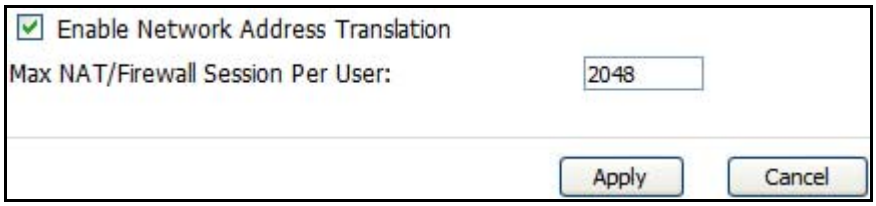


3 Select **Enable DHCP Server**, then enter 192.168.100.34 as your **IP Pool Starting Address** and 32 for your **Pool Size**.

4 In the **DNS Server** section, set the **First**, **Second** and **Third DNS Server** fields to **From ISP** in order to use the DNS servers linked to your ISP.

5 Click **Apply** to save your DHCP settings.

6 Next, go to the **ADVANCED > NAT Configuration > General** screen and select the **Enable Network Address Translation** option.



7 Click **Apply** to save your settings.

8 Connect your computers to the WiMAX Modem's Ethernet ports and you're all set!

Note: You may need to configure the computers on your LAN to automatically obtain IP addresses. For information on how to do this, see Appendix B on page 271.

5.2.1 Connecting Your Small Network to the Internet

Once your network is configured and hooked up, you will want to connect it to the Internet next. To do this, just run the **Internet Connection Wizard** (Chapter 3 on page 41), which walks you through the process.

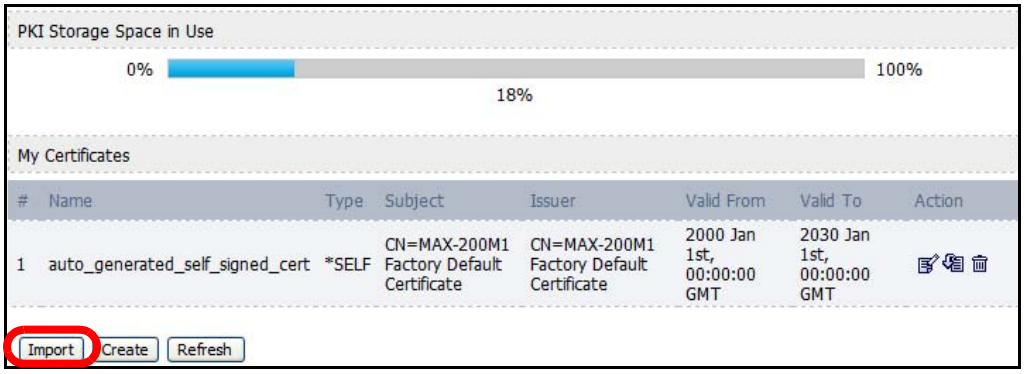
5.2.2 Changing Service Providers

This tutorial shows you how to import a new security certificate, which allows your device to communicate with the company's network servers. This is necessary if you ever change Internet Service Providers and your WiMAX Modem is still compatible with the new network. (In some cases it may not be.)

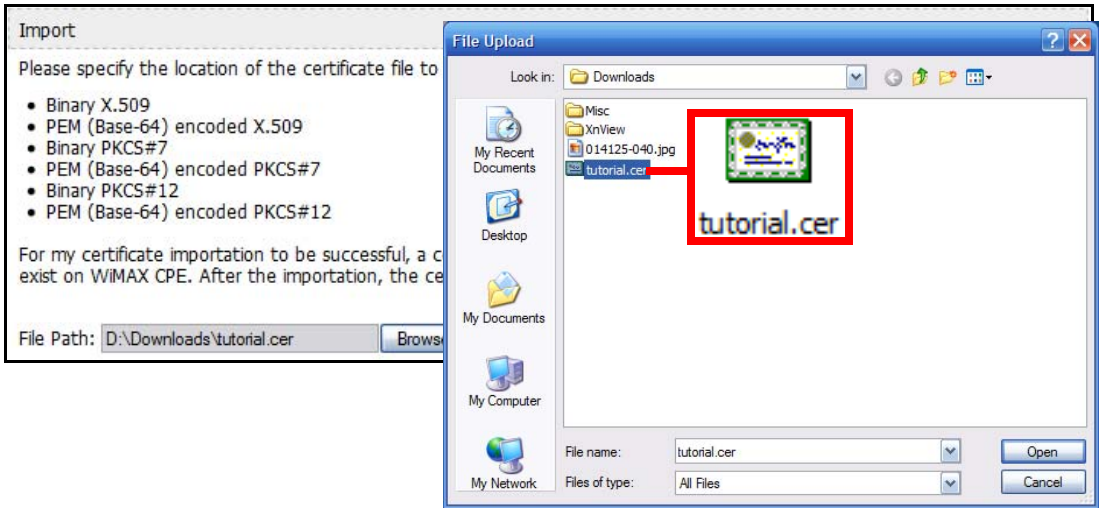
Goal: Import a new security certificate into the WiMAX Modem.

See Also: Chapter 15 on page 167.

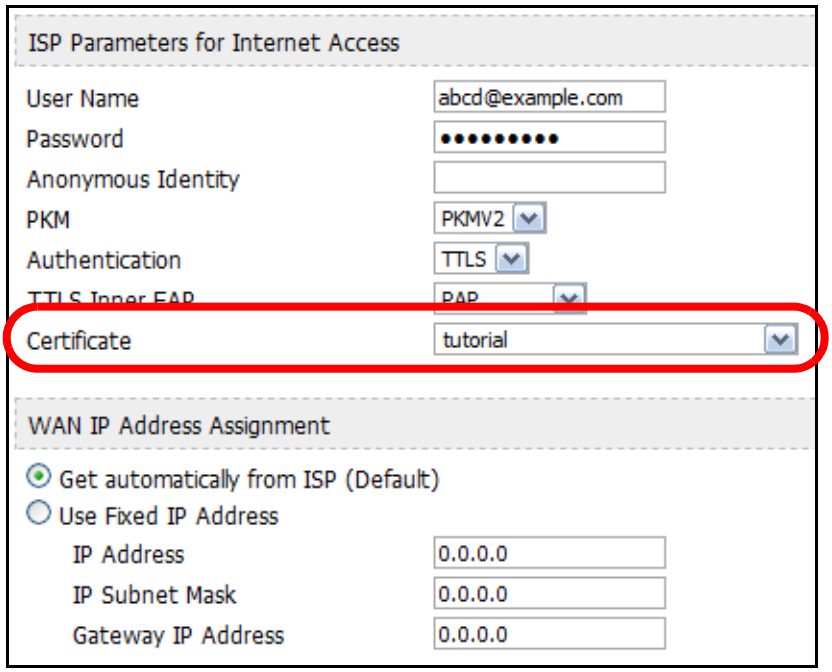
1 In the Web Configurator, open the **TOOLS > Certificates > My Certificates** screen and click the **Import** button.


PKI Storage Space in Use
0%
100%
18%
My Certificates
Name Type Subject Issuer Valid From Valid To Action
1 auto_generated_self_signed_cert *SELF CN=MAX-200M1 Factory Default Certificate CN=MAX-200M1 Factory Default Certificate 2000 Jan 1st, 00:00:00 GMT 2030 Jan 1st, 00:00:00 GMT
Import
Create
Refresh

2 In the **Import Certificate** screen, click **Browse** and locate the security certificate that was provided by your new ISP.



3 Next, go to the **ADVANCED > WAN Configuration** screen and configure your new Internet access settings based on the information provided by your ISP.



Note: You can also use the Internet Connection Wizard to configure these settings.

4 From the **Certificates** menu, select the security certificate that you just imported.

5 Click **Apply** to save your settings. You should now be able to connect to the Internet through your new service provider!

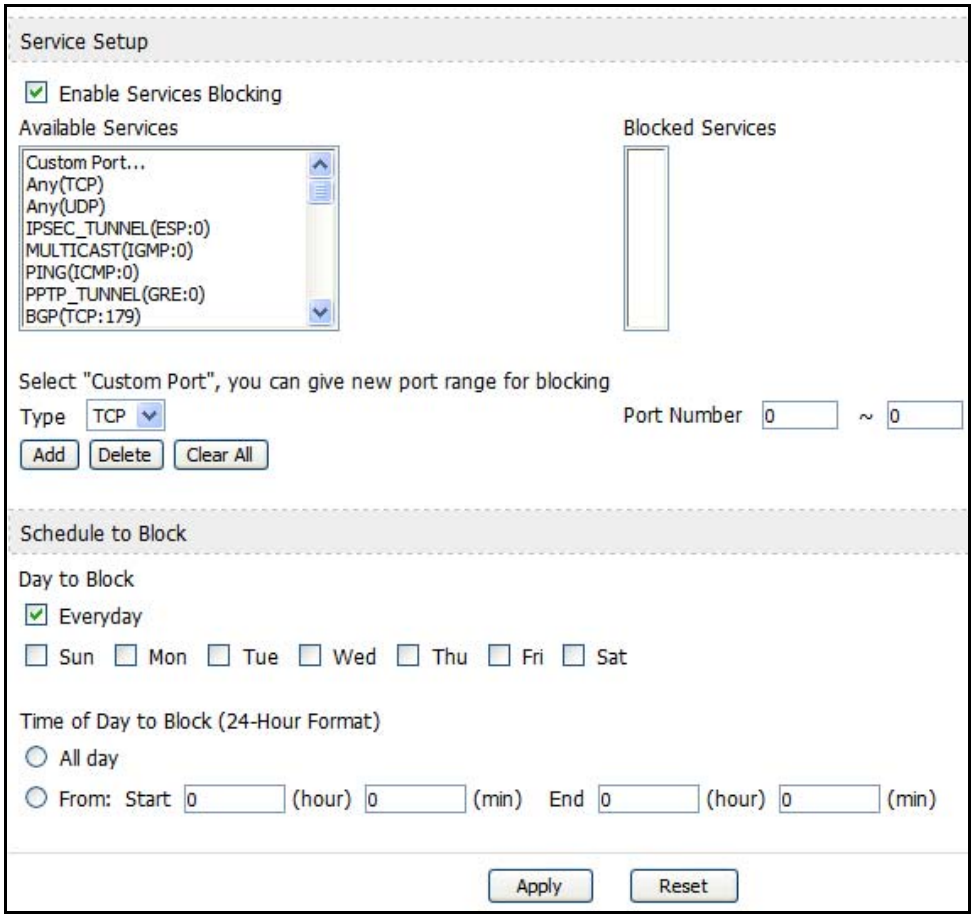
5.2.3 Blocking Web Access During Specific Hours

If your WiMAX Modem is in a home or office environment you may decide that you want to block web access and video chat during a specific block of hours, such as during your daughter's designated study hours.

Goal: Configure the WiMAX Modem's firewall to block web and video chat access on weekdays between the hours of 3:30 PM and 8:30 PM.'

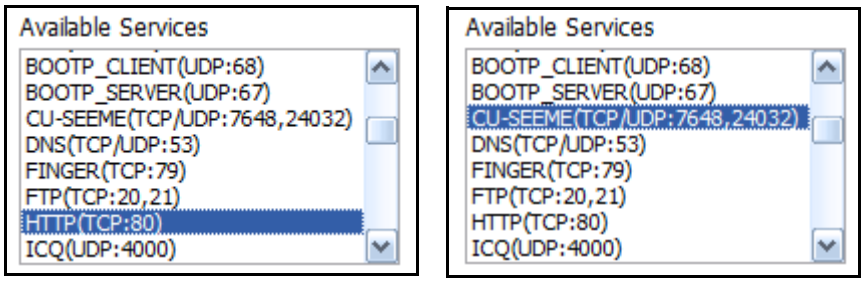
See Also: Chapter 16 on page 189.

1 Open the **TOOLS > Firewall > Services** to screen.



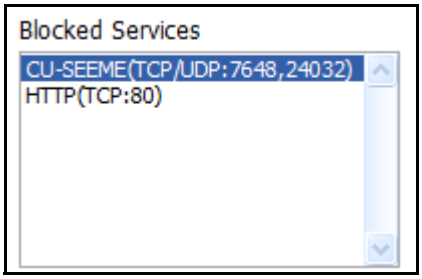
2 Select **Enable Services Blocking**.

3 Under **Available Services**, select **HTTP(TCP:80)** then click the **Add** button. Repeat this for **CU-SEEME(TCP/UDP:7648,24032)**.

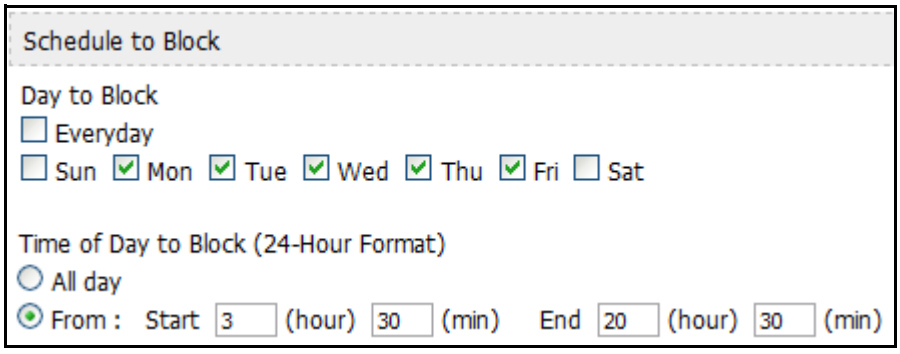


This blocks all web and video chat traffic, while leaving other ports open for other types of traffic, such as ports 25 and 587 for e-mail and port 21 for FTP.

The **Blocked Services** window updates accordingly.



4 Next, configure the **Schedule to Block** area with the days and hours for blocking web access to your employees.


Schedule to Block
Day to Block
Everyday
Sun Mon Tue Wed Thu Fri Sat
Time of Day to Block (24-Hour Format)
All day
From : Start 3 (hour) 30 (min) End 20 (hour) 30 (min)

In this example, the five weekly work days are selected as well as the standard work hours of 3:30 PM to 8:30 PM (or 20:30 in 24-hour format).

5 Finally, click **Apply** to save your settings.

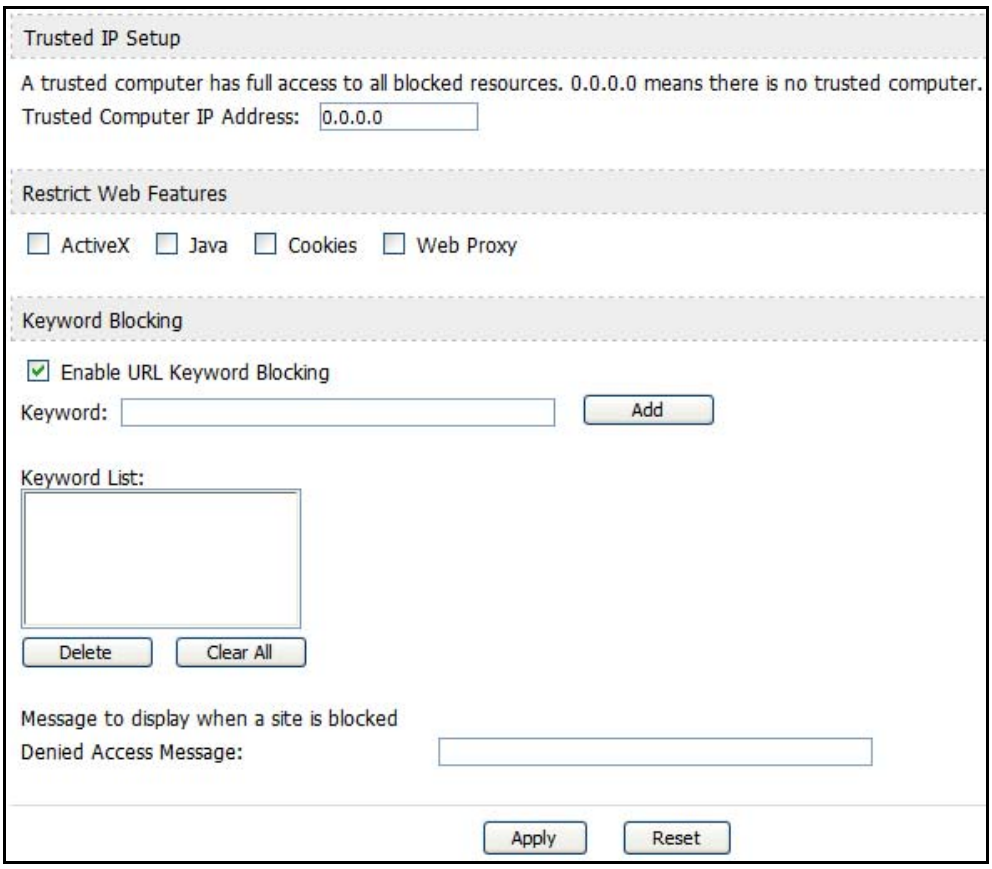
5.2.4 Blocking Web Sites by Keyword

You can further refine web access by specifying keywords that appear in a URL and blocking them. This allows you to control the content you do allow to pass through the WiMAX Modem. For example, once your daughter's designated study hours end, you allow web access and video chat but want to restrict certain sites.

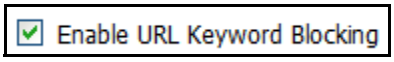
Goal: Restrict websites with the words "poker", "sex", and "beer" in their URLs.

See Also: Chapter 17 on page 199.

1 Open the **TOOLS > Content Filter > Filter** screen.

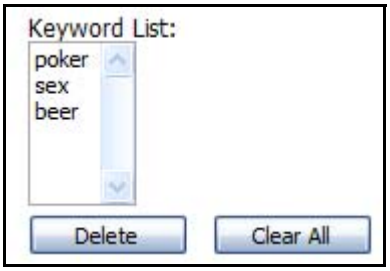


2 Select **Enable URL Keyword Blocking**.

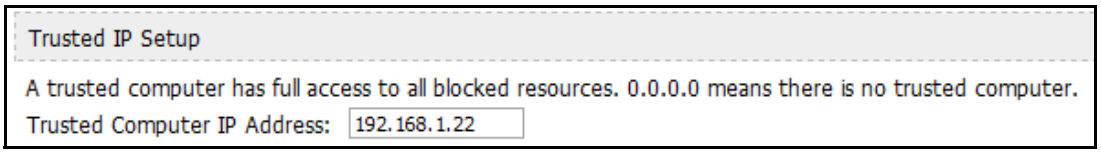


3 Enter the first **Keyword** then click **Add**. Repeat for additional keywords.

As you enter them, the keywords appear in the **Keyword List**.

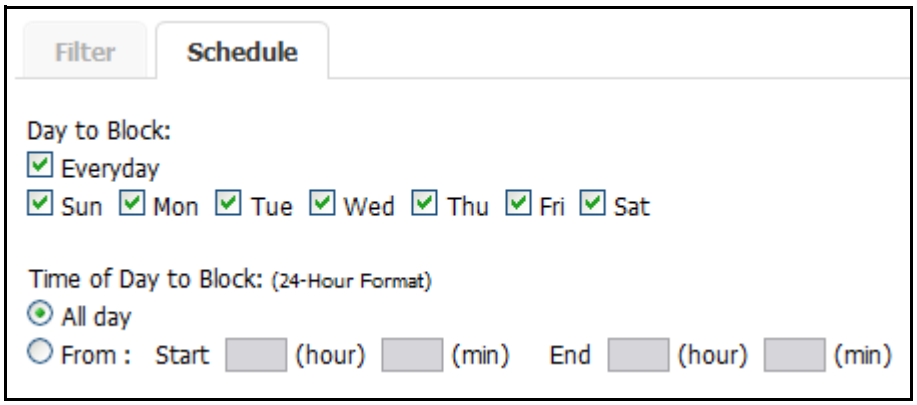


4 (Optional) If you want to allow websites with these keywords for a specific computer in your household, such as the computer in the master bedroom, then add that computer's IP address to the **Trusted IP Address** field.


Trusted IP Setup
A trusted computer has full access to all blocked resources. 0.0.0.0 means there is no trusted computer.
Trusted Computer IP Address: 192.168.1.22

5 Click **Apply** to save these settings.

6 Next, open the **TOOLS > Content Filter > Schedule** screen.



7 To keep things simple, set the **Days to Block** to **Everyday** and the **Time of Day to Block** to **All Day**.

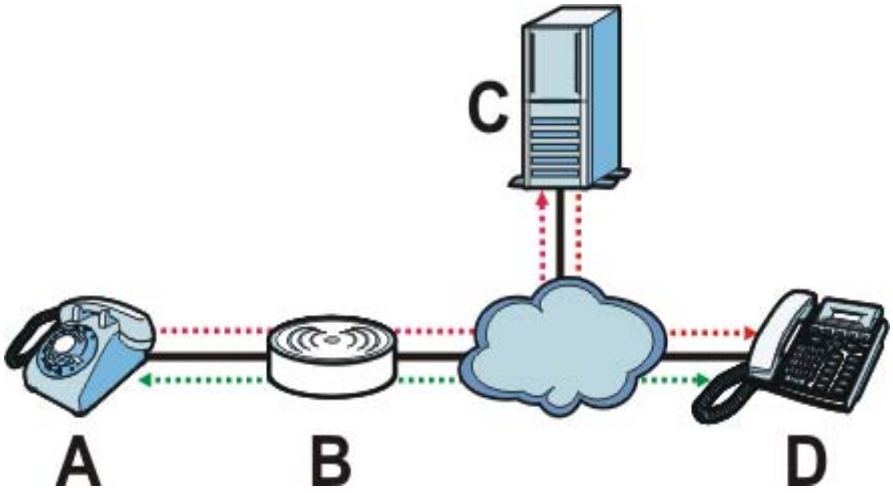
8 Click **Apply** to save these settings.

5.3 Configuring Your Internet Phone

This tutorial shows you how to configure the WiMAX Modem's VoIP settings when you connect an analog phone to place Internet phone calls.

Goals: Connect an analog phone to the WiMAX Modem then configure your Internet phone settings.

Figure 16 Phone Call Example



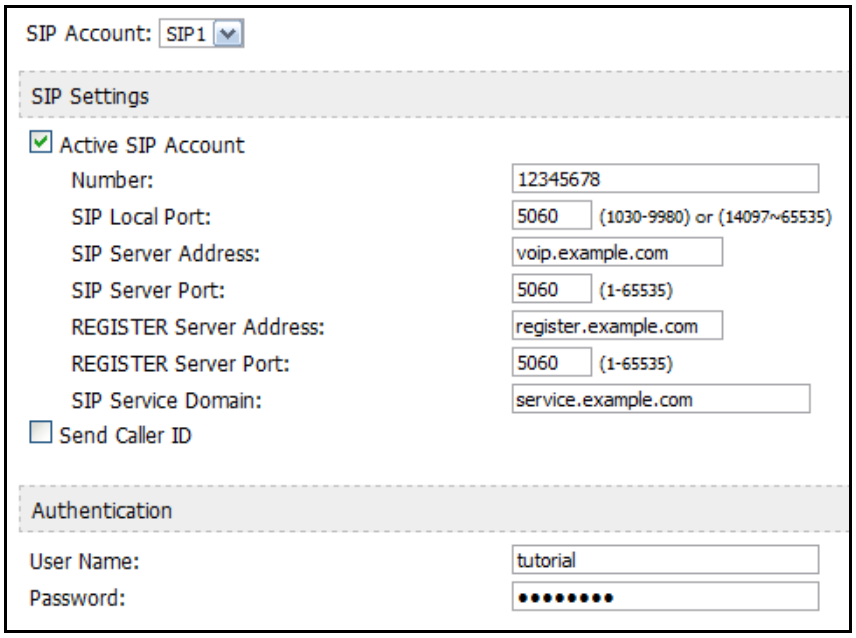
In this example, your analog phone (**A**) connects to the WiMAX Modem (**B**). When you dial a SIP number, the WiMAX Modem first connects to your account's SIP server (**C**) and presents your SIP account login credentials. The SIP server then connects to the other party (**D**) using the SIP number you just dialed; if he or she accepts, the phone conversation begins.

Required: The following table provides a summary of the information you will need to complete the tasks in this tutorial.

INFORMATION	VALUE	SEE ALSO
Number	12345678	Chapter 12 on page 131
SIP Server Address	voip.example.com	
REGISTER Server Address	register.example.com	
SIP Service Domain	service.example.com	
User Name	tutorial	
Password	abcdefg	
Incoming / Outgoing Calls	SIP1	Chapter 13 on page 149

1 Connect an analog phone to your WiMAX Modem, as described in the included Quick Start Guide.

2 Open the **VOICE > Service Configuration > SIP Setting** screen, then enter the required information as presented above.



Tip: Unless otherwise told by a SIP service provider, you can often leave the Port settings at their default values.

3 Click **Apply** to save your changes.

4 Next, click **VOICE > Phone > Analog Phone**. This is where you will configure your phone settings to bind your SIP settings to the connected phone.

Select a phone from the **Phone Port Settings** list, then select whether you want to use the SIP account settings for outgoing calls, incoming calls, or both.

Click **Apply** to save your settings and you can begin placing Internet phone calls! Go to the next section for further instructions.

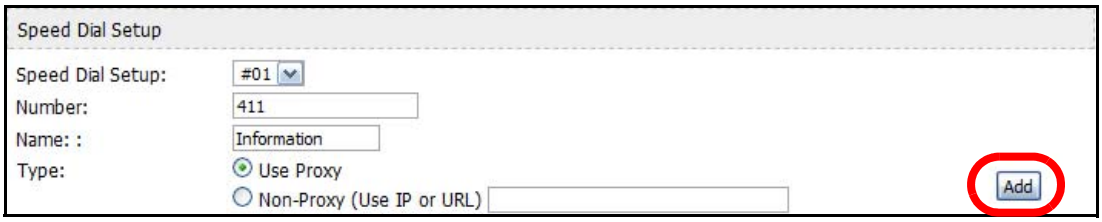
5.3.1 Placing an Internet Phone Call

Because you're using an analog phone, you can't just enter another party's SIP number and dial straight away. The reason is there is no way to enter certain SIP-specific characters on your analog phone's keypad in a way that the WiMAX Modem will recognize. As such, you must first configure a 'speed dial' entry in the WiMAX Modem's internal phone book.

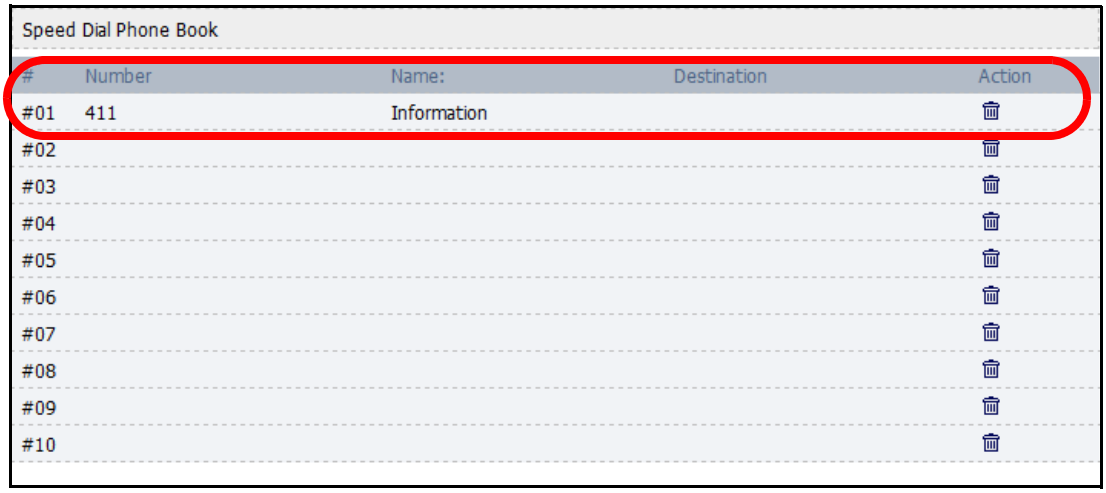
Required: The following table provides a summary of the information you will need to complete the tasks in this tutorial.

INFORMATION	VALUE	SEE ALSO
Speed Dial Setup	#01	Chapter 14 on page 159
Number	411	
Name	Information	

1 Open the **VOICE > Phone Book > Speed Dial** screen, then enter the required information as presented above.



2 Click **Add** to save the number to your speed dial list in position #1.



3 Now whenever you want to dial local Information, pick up the handset on your phone and dial '1'.

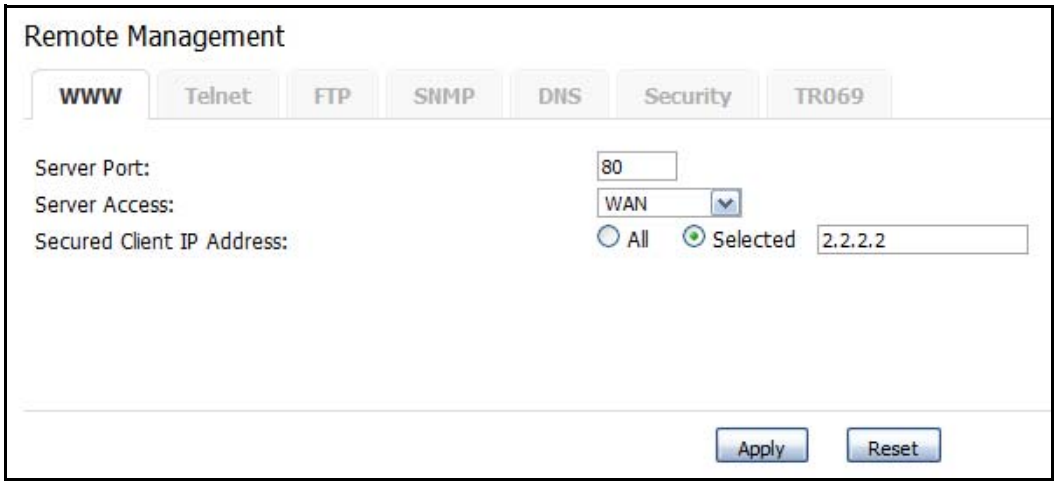
5.4 Remotely Managing Your WiMAX Modem

The remote management feature allows you to log into the device over the Internet and configure its settings from a second trusted location.

Goal: Set up the WiMAX Modem to allow management requests from the (demonstration) IP address 2.2.2.2.

See Also: Chapter 18 on page 203.

1 Open the **TOOLS > Remote Management > WWW** screen.



2 Leave the **Server Port** setting as ‘80’, in order to allow computers back at the WiMAX Modem’s location to continue to access the Internet.

3 From the **Server Access** menu, select **WAN**. This allows remote management connections only from the Internet.

4 Finally, in the **Secured Client IP Address** field enter 2.2.2.2 as the IP address from which you will be connecting to the WiMAX Modem. Any other attempts by computer on the Internet to connect will be rejected because their IP addresses won’t match the one specified here.

5 Click **Apply** to save your changes.

PART II
Basic Screens

The Main Screen (38)

The Setup Screens (65)

6

The Setup Screens

6.1 Overview

Use these screens to configure or view LAN, DHCP Client and WAN settings.

6.1.1 What You Can Do in This Chapter

- The **Set IP Address** screen (Section 6.2 on page 66) lets you configure the WiMAX Modem's IP address and subnet mask.
- The **DHCP Client** screen (Section 6.3 on page 67) to view connection information for clients configured by the WiMAX Modem's internal DHCP server.
- The **Time Setting** screen (Section 6.4 on page 68) lets you configure your WiMAX Modem's time and date keeping settings.

6.1.2 What You Need to Know

The following terms and concepts may help as you read through this chapter.

LAN

A Local Area Network, or a shared communication system to which many computers are attached. A LAN, as its name implies, is limited to a local area such as a home or office environment. LANs have different topologies, the most common being the linear bus and the star configuration.

IP Address

IP addresses identify individual devices on a network. Every networking device (including computers, servers, routers, printers, etc.) needs an IP address to communicate across the network. These networking devices are also known as hosts.

Subnet Mask

The subnet mask specifies the network number portion of an IP address. Your device will compute the subnet mask automatically based on the IP Address that

you entered. You do not need to change the computer subnet mask unless you are instructed to do so.

Daytime

A network protocol used by devices for debugging and time measurement. A computer can use this protocol to set its internal clock but only if it knows in which order the year, month, and day are returned by the server. Not all servers use the same format.

Time

A network protocol for retrieving the current time from a server. The computer issuing the command compares the time on its clock to the information returned by the server, adjusts itself automatically for time zone differences, then calculates the difference and corrects itself if there has been any temporal drift.

NTP

NTP stands for Network Time Protocol. It is employed by devices connected to the Internet in order to obtain a precise time setting from an official time server. These time servers are accurate to within 200 microseconds.

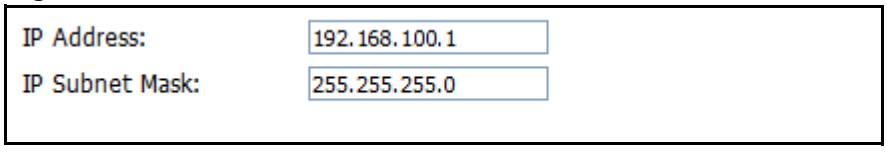
6.1.3 Before You Begin

- Make sure that you have made all the appropriate hardware connections to the WiMAX Modem, as described in the Quick Start Guide.
- Make sure that you have logged in to the web configurator at least one time and changed your password from the default, as described in the Quick Start Guide.

6.2 Set IP Address

Click the **SETUP** icon in the navigation bar to set up the WiMAX Modem's IP address and subnet mask. This screen displays this screen by default. If you are in any other sub-screen you can simply choose **Set IP Address** from the navigation menu on the left to open it again.

Figure 17 SETUP > Set IP Address



The following table describes the labels in this screen.

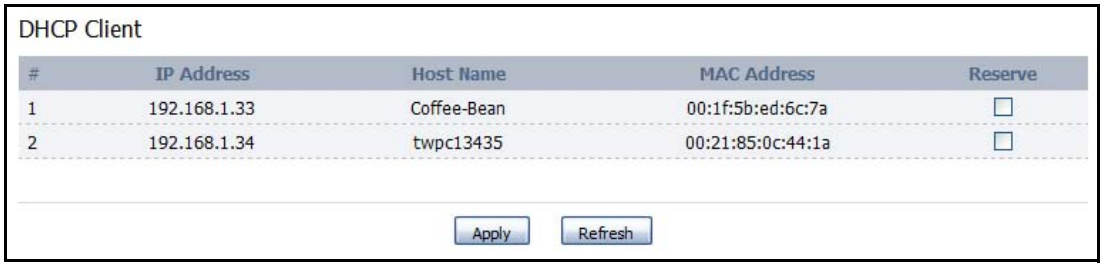
Table 9 SETUP > Set IP Address

LABEL	DESCRIPTION
IP Address	Enter the IP address of the WiMAX Modem on the LAN. Note: This field is the IP address you use to access the WiMAX Modem on the LAN. If the web configurator is running on a computer on the LAN, you lose access to it as soon as you change this field and click **Apply**. You can access the web configurator again by typing the new IP address in the browser.
IP Subnet Mask	Enter the subnet mask of the LAN.
Apply	Click to save your changes.
Clear	Click to restore your previously saved settings.

6.3 DHCP Client

Click the **SETUP > DHCP Client** to view connection information for all clients that have been configured by the WiMAX Modem's internal DHCP server.

Figure 18 SETUP > DHCP Client



The following table describes the labels in this screen.

Table 10 SETUP > DHCP Client

LABEL	DESCRIPTION
#	This indicates the number of the item in this list.
IP Address	This indicates the IP address of a connected client device.
Host Name	This indicates the host name of a connected client device. If the device is computer, then the host name is the computer name.
MAC Address	This indicates the MAC address of a connected client device.

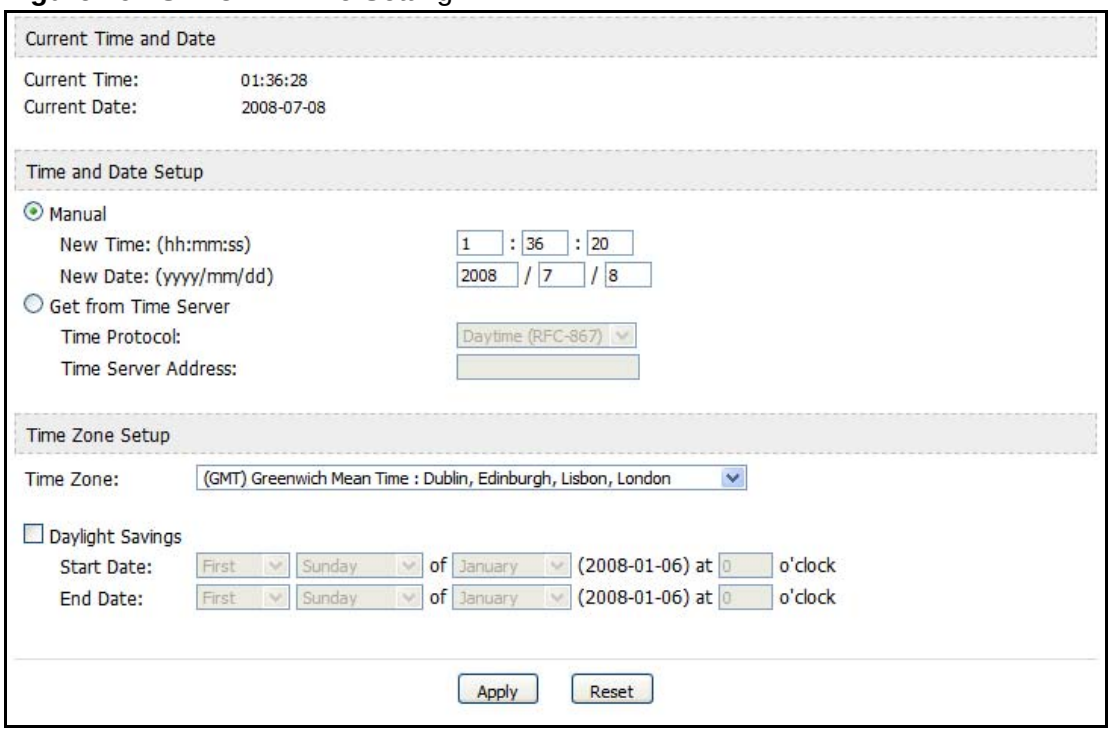
Table 10 SETUP > DHCP Client (continued)

LABEL	DESCRIPTION
Reserve	This indicates whether the IP address for the connected client device is reserved. When the DHCP server issues IP addresses, reserved IPs are assigned to specific client devices. If the IP address is reserved, the client device identified by its MAC address will always receive this IP address from the DHCP server.
Apply	Click to save your changes.
Refresh	Click to refresh the information in the screen.

6.4 Time Setting

Click **SETUP > Time Setting** to set the date, time, and time zone for the WiMAX Modem.

Figure 19 SETUP > Time Setting


Current Time and Date
Current Time: 01:36:28
Current Date: 2008-07-08
Time and Date Setup
Manual
New Time: (hh:mm:ss) 1 : 36 : 20
New Date: (yyyy/mm/dd) 2008 / 7 / 8
Get from Time Server
Time Protocol: Daytime (RFC-867)
Time Server Address:
Time Zone Setup
Time Zone: (GMT) Greenwich Mean Time : Dublin, Edinburgh, Lisbon, London
Daylight Savings
Start Date: First Sunday of January (2008-01-06) at 0 o'clock
End Date: First Sunday of January (2008-01-06) at 0 o'clock
Apply
Reset

The following table describes the labels in this screen.

Table 11 SETUP > Time Setting

LABEL	DESCRIPTION
Current Time and Date	
Current Time	Displays the current time according to the WiMAX Modem.

Table 11 SETUP > Time Setting (continued)

LABEL	DESCRIPTION
Current Date	Displays the current time according to the WiMAX Modem.
Time and Date Setup	
Manual	Select this if you want to specify the current date and time in the fields below.
New Time	Enter the new time in this field, and click **Apply**.
New Date	Enter the new date in this field, and click **Apply**.
Get from Time Server	Select this if you want to use a time server to update the current date and time in the WiMAX Modem.
Time Protocol	Select the time service protocol that your time server uses.Check with your ISP or network administrator, or use trial-and-error to find a protocol that works. **Daytime (RFC 867)** - This format is day/month/year/time zone. **Time (RFC 868)** - This format displays a 4-byte integer giving the total number of seconds since 1970/1/1 at 0:0:0. **NTP (RFC 1305)** - This format is similar to Time (RFC 868).
Time Server Address	Enter the IP address or URL of your time server. Check with your ISP or network administrator if you are unsure of this information.
Time Zone Setup	
Time Zone	Select the time zone at your location.
Daylight Savings	Select this if your location uses daylight savings time. Daylight savings is a period from late spring to early fall when many places set their clocks ahead of normal local time by one hour to give more daytime light in the evening.
Start Date	Enter which hour on which day of which week of which month daylight-savings time starts.
End Date	Enter which hour on the which day of which week of which month daylight-savings time ends.
Apply	Click to save your changes.
Reset	Click to restore your previously saved settings.

6.4.1 Pre-Defined NTP Time Servers List

The WiMAX Modem uses a pre-defined list of NTP time servers if you do not specify a time server or it cannot synchronize with the time server you specified. It can use this list regardless of the time protocol you select.

When the WiMAX Modem uses the list, it randomly selects one server and tries to synchronize with it. If the synchronization fails, then it goes through the rest of

the list in order until either it is successful or all the pre-defined NTP time servers have been tried.

Table 12 Pre-defined NTP Time Servers

ntp1.cs.wisc.edu
ntp1.gbg.netnod.se
ntp2.cs.wisc.edu
tock.usno.navy.mil
ntp3.cs.wisc.edu
ntp.cs.strath.ac.uk
ntp1.sp.se
time1.stupi.se
tick.stdtime.gov.tw
tock.stdtime.gov.tw
time.stdtime.gov.tw

6.4.2 Resetting the Time

The WiMAX Modem automatically resets the time in the following circumstances:

- When the device starts up, such as when you press the **Power** button.
- When you click **Apply** in the **SETUP > Time Setting** screen.
- Once every 24-hours after starting up.

PART III
Advanced Screens

The LAN Configuration Screens (73)

The WAN Configuration Screens (85)

The NAT Configuration Screens (109)

The System Configuration Screens (119)

7

The LAN Configuration Screens

7.1 Overview

Use the **ADVANCED > LAN Configuration** screens to set up the WiMAX Modem on the LAN. You can configure DHCP services and control how the WiMAX Modem sends routing information using RIP.

A Local Area Network (LAN) is a shared communication system to which many computers are attached. A LAN is usually a computer network limited to the immediate area, such as the same building or floor of a building.

7.1.1 What You Can Do in This Chapter

- The **DHCP Setup** screen (Section 7.2 on page 74) lets you enable, disable, and configure the DHCP server in the WiMAX Modem.
- The **Static DHCP** screen (Section 7.3 on page 76) lets you assign specific IP addresses to specific computers on the LAN.
- The **IP Static Route** screen (Section 7.4 on page 77) lets you examine the static routes configured in the WiMAX Modem.
- The **Other Settings** screen (Section 7.5 on page 79) lets you control the routing information that is sent and received by each subnet assign specific IP addresses to specific computers on the LAN.

7.1.2 What You Need to Know

The following terms and concepts may help as you read through this chapter.

IP Address

IP addresses identify individual devices on a network. Every networking device (including computers, servers, routers, printers, etc.) needs an IP address to communicate across the network. These networking devices are also known as hosts.

Subnet Masks

Subnet masks determine the maximum number of possible hosts on a network. You can also use subnet masks to divide one network into multiple sub-networks.

DNS

DNS (Domain Name System) is for mapping a domain name to its corresponding IP address and vice versa. The DNS server is extremely important because without it, you must know the IP address of a networking device before you can access it.

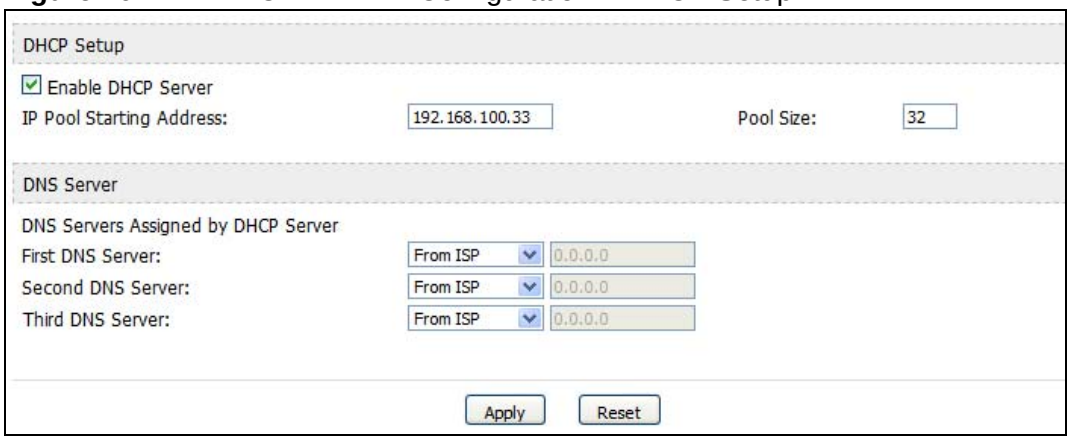
DHCP

A DHCP (Dynamic Host Configuration Protocol) server can assign your WiMAX Modem an IP address, subnet mask, DNS and other routing information when it's turned on.

7.2 DHCP Setup

Click **ADVANCED > LAN Configuration > DHCP Setup** to enable, disable, and configure the DHCP server in the WiMAX Modem.

Figure 20 ADVANCED > LAN Configuration > DHCP Setup



The following table describes the labels in this screen.

Table 13 ADVANCED > LAN Configuration > DHCP Setup

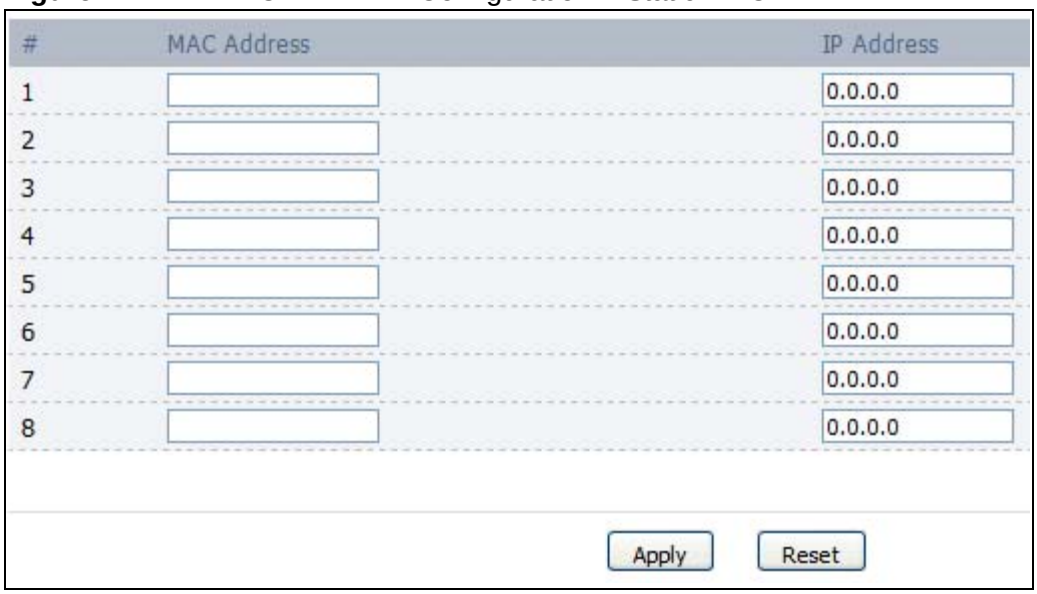
LABEL	DESCRIPTION
DHCP Setup	
Enable DHCP Server	Select this if you want the WiMAX Modem to be the DHCP server on the LAN. As a DHCP server, the WiMAX Modem assigns IP addresses to DHCP clients on the LAN and provides the subnet mask and DNS server information.
IP Pool Starting Address	Enter the IP address from which the WiMAX Modem begins allocating IP addresses, if you have not specified an IP address for this computer in **ADVANCED > LAN Configuration > Static DHCP**.
Pool Size	Enter the number of IP addresses to allocate. This number must be at least one and is limited by a subnet mask of 255.255.255.0 (regardless of the subnet the WiMAX Modem is in). For example, if the **IP Pool Start Address** is 10.10.10.10, the WiMAX Modem can allocate up to 10.10.10.254, or 245 IP addresses.
DNS Server	
First, Second and Third DNS Server	Specify the IP addresses of a maximum of three DNS servers that the network can use. The WiMAX Modem provides these IP addresses to DHCP clients. You can specify these IP addresses two ways. **From ISP** - provide the DNS servers provided by the ISP on the WAN port. **User Defined** - enter a static IP address. **DNS Relay** - this setting will relay DNS information from the DNS server obtained by the WiMAX Modem. **None** - no DNS service will be provided by the WiMAX Modem.
Apply	Click to save your changes.
Reset	Click to restore your previously saved settings.

7.3 Static DHCP

Click **ADVANCED > LAN Configuration > Static DHCP** to assign specific IP addresses to specific computers on the LAN.

Note: This screen has no effect if the DHCP server is not enabled. You can enable it in **ADVANCED > LAN Configuration > DHCP Setup**.

Figure 21 ADVANCED > LAN Configuration > Static DHCP



The following table describes the labels in this screen.

Table 14 ADVANCED > LAN Configuration > Static DHCP

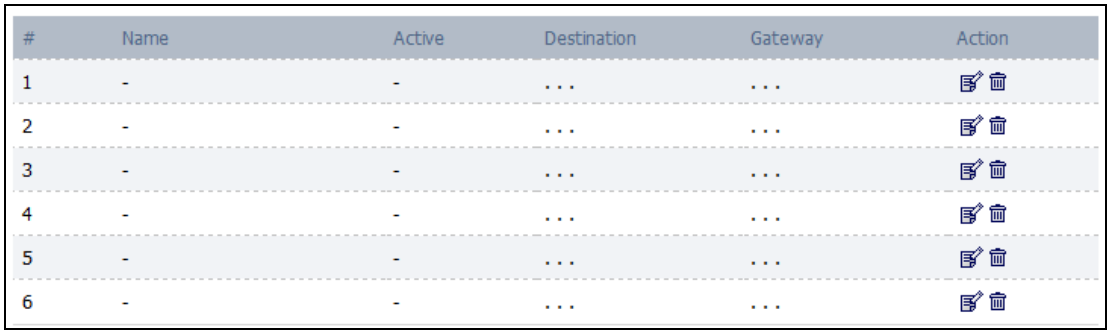
LABEL	DESCRIPTION
#	The number of the item in this list.
MAC Address	Enter the MAC address of the computer to which you want the WiMAX Modem to assign the same IP address.
IP Address	Enter the IP address you want the WiMAX Modem to assign to the computer.
Apply	Click to save your changes.
Reset	Click to restore your previously saved settings.

7.4 IP Static Route

Click **ADVANCED > LAN Configuration > IP Static Route** to look at the static routes configured in the WiMAX Modem.

Note: The first static route is the default route and cannot be modified or deleted.

Figure 22 Advanced> LAN Configuration > IP Static Route



The following table describes the icons in this screen.

Table 15 Advanced> LAN Configuration > IP Static Route

ICON	DESCRIPTION
	Edit Click to edit this item.
	Delete Click to delete this item.

The following table describes the labels in this screen.

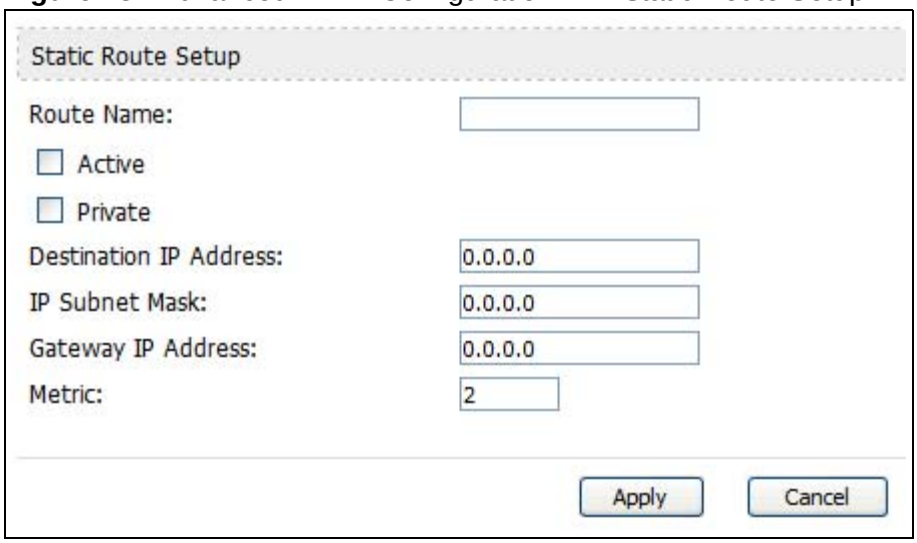
Table 16 Advanced> LAN Configuration > IP Static Route

LABEL	DESCRIPTION
#	The number of the item in this list.
Name	This field displays the name that describes the static route.
Active	This field shows whether this static route is active (**Yes**) or not (**No**).
Destination	This field displays the destination IP address(es) that this static route affects.
Gateway	This field displays the IP address of the gateway to which the WiMAX Modem should send packets for the specified **Destination**. The gateway is a router or a switch on the same network segment as the device's LAN or WAN port. The gateway helps forward packets to their destinations.

7.4.1 IP Static Route Setup

Click an **Edit** icon in **ADVANCED > LAN Configuration > IP Static Route** to edit a static route in the WiMAX Modem.

Figure 23 Advanced> LAN Configuration > IP Static Route Setup



The following table describes the labels in this screen.

Table 17 Advanced> LAN Configuration > IP Static Route > Edit

LABEL	DESCRIPTION
Route Name	Enter the name of the static route.
Active	Select this if you want the static route to be used. Clear this if you do not want the static route to be used.
Private	Select this if you do not want the WiMAX Modem to tell other routers about this static route. For example, you might select this if the static route is in your LAN. Clear this if you want the WiMAX Modem to tell other routers about this static route.
Destination IP Address	Enter one of the destination IP addresses that this static route affects.
IP Subnet Mask	Enter the subnet mask that defines the range of destination IP addresses that this static route affects. If this static route affects only one IP address, enter 255.255.255.255.
Gateway IP Address	Enter the IP address of the gateway to which the WiMAX Modem should send packets for the specified **Destination**. The gateway is a router or a switch on the same network segment as the device's LAN or WAN port. The gateway helps forward packets to their destinations.
Metric	Usually, you should keep the default value. This field is related to RIP. The metric represents the "cost of transmission". A router determines the best route for transmission by choosing a path with the lowest "cost". The smaller the metric, the lower the "cost". RIP uses hop count as the measurement of cost, where 1 is for a directly-connected network. The metric must be 1-15; if you use a value higher than 15, the routers assume the link is down.

Table 17 Advanced> LAN Configuration > IP Static Route > Edit (continued)

LABEL	DESCRIPTION
Apply	Click to save your changes.
Cancel	Click to return to the previous screen without saving your changes.

7.5 Other Settings

Click **ADVANCED > LAN Configuration > Other Settings** to set the RIP and Multicast options.

Figure 24 ADVANCED > LAN Configuration > Other Settings

The following table describes the labels in this screen.

Table 18 ADVANCED > LAN Configuration > Other Settings

LABEL	DESCRIPTION
RIP & Multicast Setup	
RIP Direction	Use this field to control how much routing information the WiMAX Modem sends and receives on the subnet. • **None** - The WiMAX Modem does not send or receive routing information on the subnet. • **Both** - The WiMAX Modem sends and receives routing information on the subnet. • **In Only** - The WiMAX Modem only receives routing information on the subnet. • **Out Only** - The WiMAX Modem only sends routing information on the subnet.
RIP Version	Select which version of RIP the WiMAX Modem uses when it sends or receives information on the subnet. • **RIP-1** - The WiMAX Modem uses RIPv1 to exchange routing information. • **RIP-2B** - The WiMAX Modem broadcasts RIPv2 to exchange routing information. • **RIP-2M** - The WiMAX Modem multicasts RIPv2 to exchange routing information.

Table 18 ADVANCED > LAN Configuration > Other Settings (continued)

LABEL	DESCRIPTION
Multicast	You do not have to enable multicasting to use **RIP-2M**. (See **RIP Version**.) Select which version of IGMP the WiMAX Modem uses to support multicasting on the LAN. Multicasting sends packets to some computers on the LAN and is an alternative to unicasting (sending packets to one computer) and broadcasting (sending packets to every computer). • **None** - The WiMAX Modem does not support multicasting. • **IGMP-v1** - The WiMAX Modem supports IGMP version 1. • **IGMP-v2** - The WiMAX Modem supports IGMP version 2. Multicasting can improve overall network performance. However, it requires extra processing and generates more network traffic. In addition, other computers on the LAN have to support the same version of IGMP.
Apply	Click to save your changes.
Reset	Click to restore your previously saved settings.

7.6 Technical Reference

The following section contains additional technical information about the WiMAX Modem features described in this chapter.

7.6.1 IP Address and Subnet Mask

Similar to the way houses on a street share a common street name, computers on a LAN share one common network number.

Where you obtain your network number depends on your particular situation. If the ISP or your network administrator assigns you a block of registered IP addresses, follow their instructions in selecting the IP addresses and the subnet mask.

If the ISP did not explicitly give you an IP network number, then most likely you have a single user account and the ISP will assign you a dynamic IP address when the connection is established. If this is the case, it is recommended that you select a network number from 192.168.0.0 to 192.168.255.0 and you must enable the Network Address Translation (NAT) feature of the WiMAX Modem. The Internet Assigned Number Authority (IANA) reserved this block of addresses specifically for private use; please do not use any other number unless you are told otherwise. Let's say you select 192.168.1.0 as the network number; which covers 254 individual addresses, from 192.168.1.1 to 192.168.1.254 (zero and 255 are reserved). In other words, the first three numbers specify the network number while the last number identifies an individual computer on that network.

Once you have decided on the network number, pick an IP address that is easy to remember, for instance, 192.168.1.1, for your WiMAX Modem, but make sure that no other device on your network is using that IP address.

The subnet mask specifies the network number portion of an IP address. Your WiMAX Modem will compute the subnet mask automatically based on the IP address that you entered. You don't need to change the subnet mask computed by the WiMAX Modem unless you are instructed to do otherwise.

7.6.2 DHCP Setup

DHCP (Dynamic Host Configuration Protocol, RFC 2131 and RFC 2132) allows individual clients to obtain TCP/IP configuration at start-up from a server. You can configure the WiMAX Modem as a DHCP server or disable it. When configured as a server, the WiMAX Modem provides the TCP/IP configuration for the clients. If DHCP service is disabled, you must have another DHCP server on your LAN, or else each computer must be manually configured.

The WiMAX Modem is pre-configured with a pool of IP addresses for the DHCP clients (DHCP Pool). See the product specifications in the appendices. Do not assign static IP addresses from the DHCP pool to your LAN computers.

These parameters should work for the majority of installations. If your ISP gives you explicit DNS server address(es), see Section 7.3 on page 76.

7.6.3 LAN TCP/IP

The WiMAX Modem has built-in DHCP server capability that assigns IP addresses and DNS servers to systems that support DHCP client capability.

The LAN parameters of the WiMAX Modem are preset in the factory with the following values:

- IP address of 192.168.1.1 with subnet mask of 255.255.255.0 (24 bits)
- DHCP server enabled with 32 client IP addresses starting from 192.168.1.33.

These parameters should work for the majority of installations. If your ISP gives you explicit DNS server address(es), see Section 7.3 on page 76.

7.6.4 DNS Server Address

DNS (Domain Name System) is for mapping a domain name to its corresponding IP address and vice versa. The DNS server is extremely important because without it, you must know the IP address of a machine before you can access it. The DNS server addresses that you enter in the DHCP setup are passed to the client machines along with the assigned IP address and subnet mask.

There are two ways that an ISP disseminates the DNS server addresses. The first is for an ISP to tell a customer the DNS server addresses, usually in the form of an information sheet, when s/he signs up. If your ISP gives you the DNS server addresses, enter them in the **DNS Server** fields in **DHCP Setup**, otherwise, leave them blank.

Some ISPs choose to pass the DNS servers using the DNS server extensions of PPP IPCP (IP Control Protocol) after the connection is up. If your ISP did not give you explicit DNS servers, chances are the DNS servers are conveyed through IPCP negotiation. The WiMAX Modem supports the IPCP DNS server extensions through the DNS proxy feature.

If the **Primary** and **Secondary DNS Server** fields in the **LAN Setup** screen are not specified, for instance, left as 0.0.0.0, the WiMAX Modem tells the DHCP clients that it itself is the DNS server. When a computer sends a DNS query to the WiMAX Modem, the WiMAX Modem forwards the query to the real DNS server learned through IPCP and relays the response back to the computer.

Please note that DNS proxy works only when the ISP uses the IPCP DNS server extensions. It does not mean you can leave the DNS servers out of the DHCP setup under all circumstances. If your ISP gives you explicit DNS servers, make sure that you enter their IP addresses in the **LAN Setup** screen. This way, the WiMAX Modem can pass the DNS servers to the computers and the computers can query the DNS server directly without the WiMAX Modem's intervention.

7.6.5 RIP Setup

RIP (Routing Information Protocol) allows a router to exchange routing information with other routers. The **RIP Direction** field controls the sending and receiving of RIP packets. When set to:

- **Both -** the WiMAX Modem will broadcast its routing table periodically and incorporate the RIP information that it receives.
- **In Only -** the WiMAX Modem will not send any RIP packets but will accept all RIP packets received.
- **Out Only -** the WiMAX Modem will send out RIP packets but will not accept any RIP packets received.

- **None -** the WiMAX Modem will not send any RIP packets and will ignore any RIP packets received.

The **Version** field controls the format and the broadcasting method of the RIP packets that the WiMAX Modem sends (it recognizes both formats when receiving). **RIP-1** is universally supported; but RIP-2 carries more information. RIP-1 is probably adequate for most networks, unless you have an unusual network topology.

Both **RIP-2B** and **RIP-2M** sends the routing data in RIP-2 format; the difference being that **RIP-2B** uses subnet broadcasting while **RIP-2M** uses multicasting.

7.6.6 Multicast

Traditionally, IP packets are transmitted in one of either two ways - Unicast (1 sender - 1 recipient) or Broadcast (1 sender - everybody on the network). Multicast delivers IP packets to a group of hosts on the network - not everybody and not just 1.

IGMP (Internet Group Multicast Protocol) is a network-layer protocol used to establish membership in a Multicast group - it is not used to carry user data. IGMP version 2 (RFC 2236) is an improvement over version 1 (RFC 1112) but IGMP version 1 is still in wide use. If you would like to read more detailed information about interoperability between IGMP version 2 and version 1, please see sections 4 and 5 of RFC 2236. The class D IP address is used to identify host groups and can be in the range 224.0.0.0 to 239.255.255.255. The address 224.0.0.0 is not assigned to any group and is used by IP multicast computers. The address 224.0.0.1 is used for query messages and is assigned to the permanent group of all IP hosts (including gateways). All hosts must join the 224.0.0.1 group in order to participate in IGMP. The address 224.0.0.2 is assigned to the multicast routers group.

The WiMAX Modem supports both IGMP version 1 (**IGMP-v1**) and IGMP version 2 (**IGMP-v2**). At start up, the WiMAX Modem queries all directly connected networks to gather group membership. After that, the WiMAX Modem periodically updates this information. IP multicasting can be enabled/disabled on the WiMAX Modem LAN and/or WAN interfaces in the web configurator (**LAN**; **WAN**). Select **None** to disable IP multicasting on these interfaces.

8

The WAN Configuration Screens

8.1 Overview

Use the **ADVANCED > WAN Configuration** screens to set up your WiMAX Modem's Wide Area Network (WAN) or Internet features.

A Wide Area Network (or WAN) links geographically dispersed locations to other networks or the Internet. A WAN configuration can include switched and permanent telephone circuits, terrestrial radio systems and satellite systems.

8.1.1 What You Can Do in This Chapter

- The **Internet Connection** screen (Section 8.2 on page 88) lets you set up your WiMAX Modem's Internet settings.
- The **WiMAX Configuration** screen (Section 8.3 on page 90) lets set up the frequencies used by your WiMAX Modem.
- The **Advanced** screen (Section 8.4 on page 94) lets configure your DNS server, RIP, Multicast and Windows Networking settings.

8.1.2 What You Need to Know

The following terms and concepts may help as you read through this chapter.

WiMAX

WiMAX (Worldwide Interoperability for Microwave Access) is the IEEE 802.16 wireless networking standard, which provides high-bandwidth, wide-range wireless service across wireless Metropolitan Area Networks (MANs). ZyXEL is a member of the WiMAX Forum, the industry group dedicated to promoting and certifying interoperability of wireless broadband products.

In a wireless MAN, a wireless-equipped computer is known either as a mobile station (MS) or a subscriber station (SS). Mobile stations use the IEEE 802.16e standard and are able to maintain connectivity while switching their connection from one base station to another base station (handover) while subscriber stations use other standards that do not have this capability (IEEE 802.16-2004,

for example). The following figure shows an MS-equipped notebook computer **MS1** moving from base station **BS1**'s coverage area and connecting to **BS2**.

Figure 25 WiMax: Mobile Station

WiMAX technology uses radio signals (around 2 to 10 GHz) to connect subscriber stations and mobile stations to local base stations. Numerous subscriber stations and mobile stations connect to the network through a single base station (BS), as in the following figure.

Figure 26 WiMAX: Multiple Mobile Stations

A base station's coverage area can extend over many hundreds of meters, even under poor conditions. A base station provides network access to subscriber stations and mobile stations, and communicates with other base stations.

The radio frequency and bandwidth of the link between the WiMAX Modem and the base station are controlled by the base station. The WiMAX Modem follows the base station's configuration.

Authentication

When authenticating a user, the base station uses a third-party RADIUS or Diameter server known as an AAA (Authentication, Authorization and Accounting) server to authenticate the mobile or subscriber stations.

The following figure shows a base station using an **AAA** server to authenticate mobile station **MS**, allowing it to access the Internet.

Figure 27 Using an AAA Server

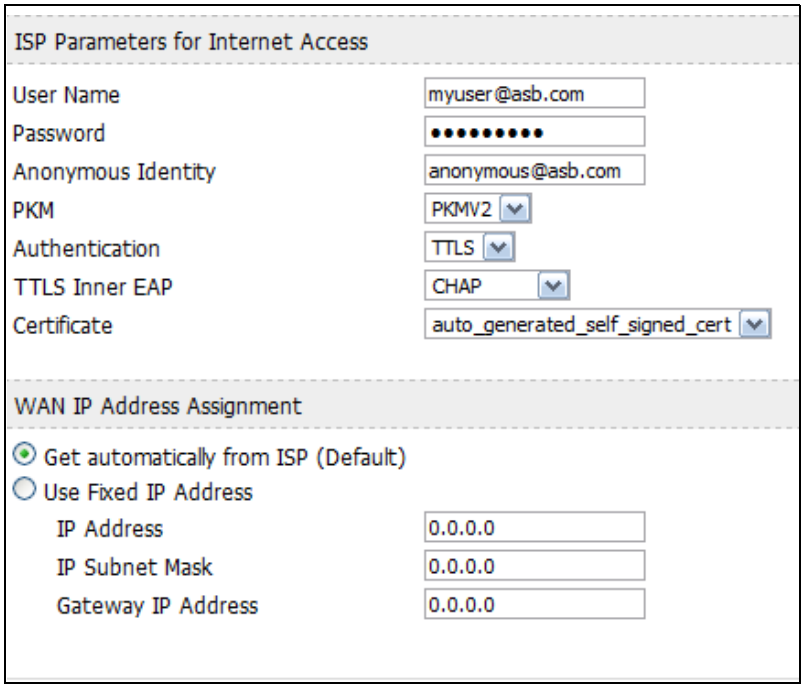
In this figure, the dashed arrow shows the PKM (Privacy Key Management) secured connection between the mobile station and the base station, and the solid arrow shows the EAP secured connection between the mobile station, the base station and the AAA server. See the WiMAX security appendix for more details.

8.2 Internet Connection

Click **ADVANCED > WAN Configuration** to set up your WiMAX Modem's Internet settings.

Note: Not all WiMAX Modem models have all the fields shown here.

Figure 28 ADVANCED > WAN Configuration > Internet Connection



The following table describes the labels in this screen.

Table 19 ADVANCED > WAN Configuration > Internet Connection > ISP Parameters for Internet Access

LABEL	DESCRIPTION
ISP Parameters for Internet Access	
User Name	Use this field to enter the username associated with your Internet access account. You can enter up to 61 printable ASCII characters.
Password	Use this field to enter the password associated with your Internet access account. You can enter up to 47 printable ASCII characters.
Anonymous Identity	Enter the anonymous identity provided by your Internet Service Provider. Anonymous identity (also known as outer identity) is used with EAP-TTLS encryption. The anonymous identity is used to route your authentication request to the correct authentication server, and does not reveal your real user name. Your real user name and password are encrypted in the TLS tunnel, and only the anonymous identity can be seen. Leave this field blank if your ISP did not give you an anonymous identity to use.

Table 19 ADVANCED > WAN Configuration > Internet Connection > ISP Parameters for Internet Access (continued)

LABEL	DESCRIPTION
PKM	This field displays the Privacy Key Management version number. PKM provides security between the WiMAX Modem and the base station. At the time of writing, the WiMAX Modem supports PKMv2 only. See the WiMAX security appendix for more information.
Authentication	This field displays the user authentication method. Authentication is the process of confirming the identity of a mobile station (by means of a username and password, for example). Check with your service provider if you are unsure of the correct setting for your account. Choose from the following user authentication methods: • **TTLS** (Tunnelled Transport Layer Security) • **TLS** (Transport Layer Security) Note: Not all WiMAX Modems support TLS authentication. Check with your service provider for details.
TTLS Inner EAP	This field displays the type of secondary authentication method. Once a secure EAP-TTLS connection is established, the inner EAP is the protocol used to exchange security information between the mobile station, the base station and the AAA server to authenticate the mobile station. See the WiMAX security appendix for more details. This field is available only when **TTLS** is selected in the **Authentication** field. The WiMAX Modem supports the following inner authentication types: • **CHAP** (Challenge Handshake Authentication Protocol) • **MSCHAP** (Microsoft CHAP) • **MSCHAPV2** (Microsoft CHAP version 2) • **PAP** (Password Authentication Protocol)
Auth Mode	Select the authentication mode from the drop-down list box. This field is not available in all WiMAX Modems. Check with your service provider for details. The WiMAX Modem supports the following authentication modes: • User Only • Device Only with Cert • Certs and User Authentication
Certificate	This is the security certificate the WiMAX Modem uses to authenticate the AAA server. Use the **TOOLS >** > **Trusted CAs** screen to import certificates to the WiMAX Modem.
WAN IP Address Assignment	

Table 19 ADVANCED > WAN Configuration > Internet Connection > ISP Parameters for Internet Access (continued)

LABEL	DESCRIPTION
Get automatically from ISP (Default)	Select this if you have a dynamic IP address. A dynamic IP address is not fixed; the ISP assigns you a different one each time you connect to the Internet.
Use Fixed IP Address	A static IP address is a fixed IP that your ISP gives you. Type your ISP assigned IP address in the **IP Address** field below.
IP Subnet Mask	Enter a subnet mask in dotted decimal notation. Refer to the appendices to calculate a subnet mask If you are implementing subnetting.
Gateway IP Address	Specify a gateway IP address (supplied by your ISP).
Apply	Click to save your changes.
Reset	Click to restore your previously saved settings.

8.3 WiMAX Configuration

Click **ADVANCED > WAN Configuration > WiMAX Configuration** to set up the frequencies used by your WiMAX Modem.

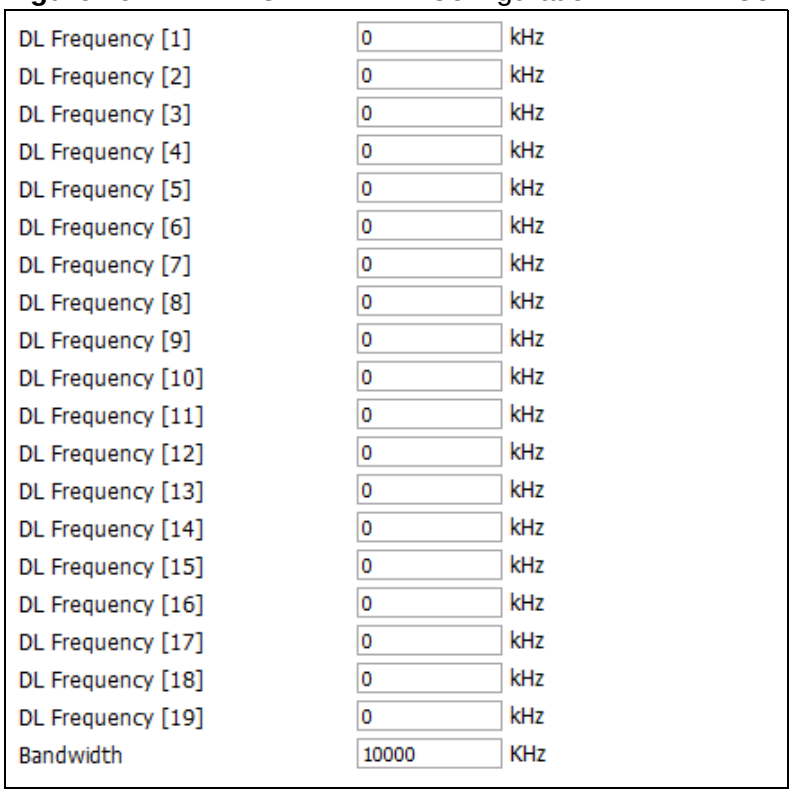
In a WiMAX network, a mobile or subscriber station must use a radio frequency supported by the base station to communicate. When the WiMAX Modem looks for a connection to a base station, it can search a range of frequencies.

Radio frequency is measured in Hertz (Hz).

Table 20 Radio Frequency Conversion

1 kHz = 1000 Hz
1 MHz = 1000 kHz (1000000 Hz)
1 GHz = 1000 MHz (1000000 kHz)

Figure 29 ADVANCED > WAN Configuration >WiMAX Configuration


DL Frequency [1] 0 kHz
DL Frequency [2] 0 kHz
DL Frequency [3] 0 kHz
DL Frequency [4] 0 kHz
DL Frequency [5] 0 kHz
DL Frequency [6] 0 kHz
DL Frequency [7] 0 kHz
DL Frequency [8] 0 kHz
DL Frequency [9] 0 kHz
DL Frequency [10] 0 kHz
DL Frequency [11] 0 kHz
DL Frequency [12] 0 kHz
DL Frequency [13] 0 kHz
DL Frequency [14] 0 kHz
DL Frequency [15] 0 kHz
DL Frequency [16] 0 kHz
DL Frequency [17] 0 kHz
DL Frequency [18] 0 kHz
DL Frequency [19] 0 kHz
Bandwidth 10000 KHz

The following table describes the labels in this screen.

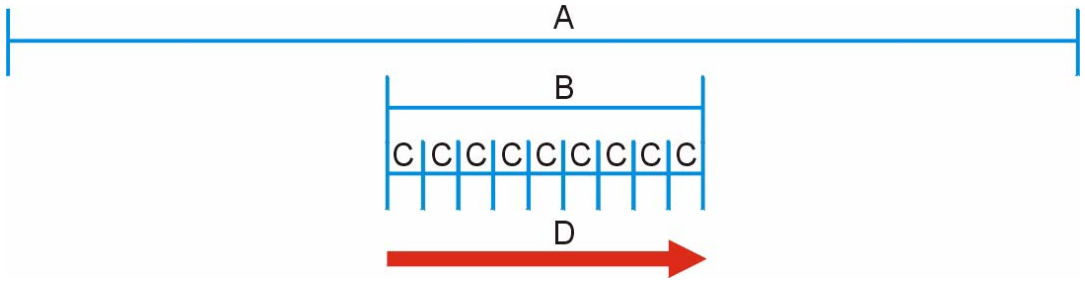
Table 21 ADVANCED > WAN Configuration >WiMAX Configuration

LABEL	DESCRIPTION
DL Frequency / Bandwidth	These fields show the downlink frequency settings in kilohertz (kHz). Enter values in these fields to have the WiMAX Modem scan these frequencies for available channels in ascending numerical order. Note: The **Bandwidth** field is not user-configurable; when the WiMAX Modem finds a WiMAX connection, its frequency is displayed in this field. Contact your service provider for details of supported frequencies.
Apply	Click to save your changes.
Reset	Click to restore your previously saved settings.

8.3.1 Frequency Ranges

The following figure shows the WiMAX Modem searching a range of frequencies to find a connection to a base station.

Figure 30 Frequency Ranges



In this figure, **A** is the WiMAX frequency range. “WiMAX frequency range” refers to the entire range of frequencies the WiMAX Modem is capable of using to transmit and receive (see the Product Specifications appendix for details).

In the figure, **B** shows the operator frequency range. This is the range of frequencies within the WiMAX frequency range supported by your operator (service provider).

The operator range is subdivided into bandwidth steps. In the figure, each **C** is a bandwidth step.

The arrow **D** shows the WiMAX Modem searching for a connection.

Have the WiMAX Modem search only certain frequencies by configuring the downlink frequencies. Your operator can give you information on the supported frequencies.

The downlink frequencies are points of the frequency range your WiMAX Modem searches for an available connection. Use the **Site Survey** screen to set these bands. You can set the downlink frequencies anywhere within the WiMAX frequency range. In this example, the downlink frequencies have been set to search all of the operator range for a connection.

8.3.2 Configuring Frequency Settings

You need to set the WiMAX Modem to scan one or more specific radio frequencies to find an available connection to a WiMAX base station.

Use the **WiMAX Frequency** screen to define the radio frequencies to be searched for available wireless connections. See Section 8.3.3 on page 93 for an example of using the **WiMAX Frequency** screen.

Note: It may take several minutes for the WiMAX Modem to find a connection.

- The WiMAX Modem searches the **DL Frequency** settings in ascending numerical order, from **[1]** to **[9]**.

Note: The **Bandwidth** field is not user-configurable; when the WiMAX Modem finds a WiMAX connection, its frequency is displayed in this field.

- If you enter a 0 in a **DL Frequency** field, the WiMAX Modem immediately moves on to the next **DL Frequency** field.
- When the WiMAX Modem connects to a base station, the values in this screen are automatically set to the base station's frequency. The next time the WiMAX Modem searches for a connection, it searches only this frequency. If you want the WiMAX Modem to search other frequencies, enter them in the **DL Frequency** fields.

The following table describes some examples of **DL Frequency** settings.

Table 22 DL Frequency Example Settings

	EXAMPLE 1	**EXAMPLE 2**
Bandwidth:	2500000	2500000
DL Frequency [1]:	2550000	2550000
DL Frequency [2]	0	2600000
DL Frequency [3]:	0	0
DL Frequency [4]:	0	0
	The WiMAX Modem searches at 2500000 kHz, and then searches at 2550000 kHz if it has not found a connection.	*The* WiMAX Modem *searches at 2500000 kHz and then at 2550000 kHz if it has not found an available connection. If it still does not find an available connection, it searches at 2600000 kHz.*

8.3.3 Using the WiMAX Frequency Screen

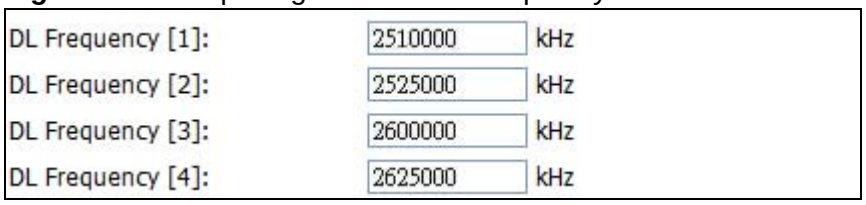
In this example, your Internet service provider has given you a list of supported frequencies: 2.51, 2.525, 2.6, and 2.625.

1. In the **DL Frequency [1]** field, enter **2510000** (2510000 kilohertz (kHz) is equal to 2.51 gigahertz).
2. In the **DL Frequency [2]** field, enter **2525000**.
3. In the **DL Frequency [3]** field, enter **2600000**.

4 In the **DL Frequency [4]** field, enter **2625000**.

Leave the rest of the **DL Frequency** fields at zero. The screen appears as follows.

Figure 31 Completing the WiMAX Frequency Screen



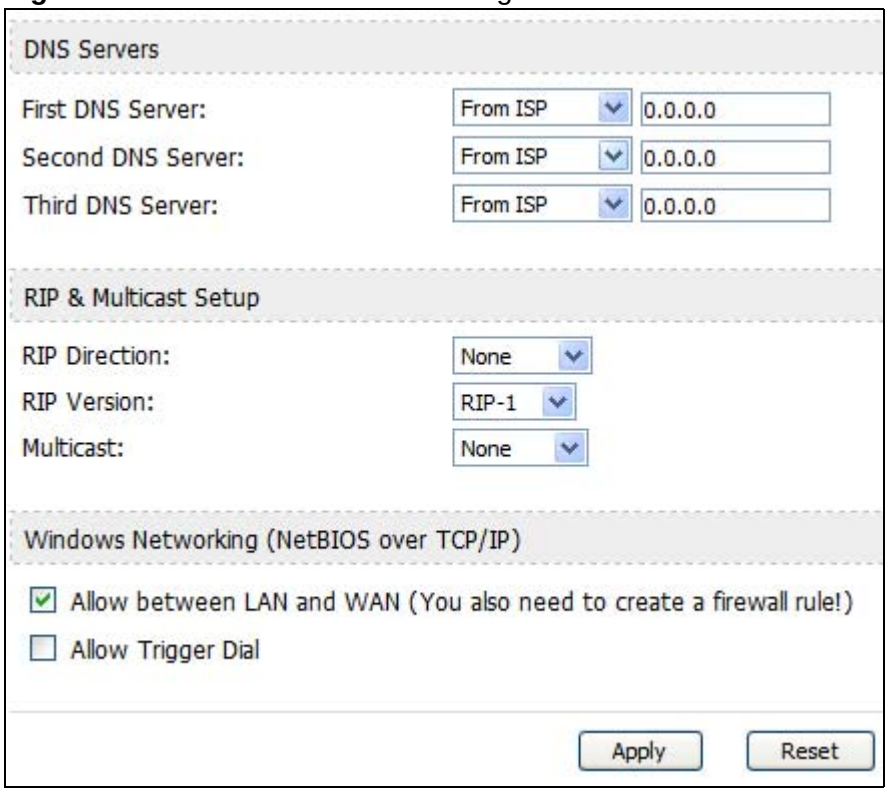
5 Click **Apply**. The WiMAX Modem stores your settings.

When the WiMAX Modem searches for available frequencies, it scans all frequencies from **DL Frequency [1]** to **DL Frequency [4]**. When it finds an available connection, the fields in this screen will be automatically set to use that frequency.

8.4 Advanced

Click **ADVANCED > WAN Configuration > Advanced** to configure your DNS server, RIP, Multicast and Windows Networking settings.

Figure 32 ADVANCED > WAN Configuration > Advanced


DNS Servers
First DNS Server: From ISP 0.0.0.0
Second DNS Server: From ISP 0.0.0.0
Third DNS Server: From ISP 0.0.0.0
RIP & Multicast Setup
RIP Direction: None
RIP Version: RIP-1
Multicast: None
Windows Networking (NetBIOS over TCP/IP)
Allow between LAN and WAN (You also need to create a firewall rule!)
Allow Trigger Dial
Apply
Reset

The following table describes the labels in this screen.

Table 23 ADVANCED > WAN Configuration > Advanced

LABEL	DESCRIPTION
DNS Servers	
First, Second and Third DNS Server	Select **Obtained from ISP** if your ISP dynamically assigns DNS server information (and the WiMAX Modem's WAN IP address). Use the drop-down list box to select a DNS server IP address that the ISP assigns in the field to the right. Select **UserDefined** if you have the IP address of a DNS server. Enter the DNS server's IP address in the field to the right. If you chose **UserDefined**, but leave the IP address set to 0.0.0.0, **UserDefined** changes to **None** after you click **Apply**. If you set a second choice to **UserDefined**, and enter the same IP address, the second **UserDefined** changes to **None** after you click **Apply**. Select **None** if you do not want to configure DNS servers. You must have another DHCP server on your LAN, or else the computers must have their DNS server addresses manually configured. If you do not configure a DNS server, you must know the IP address of a computer in order to access it.
RIP & Multicast Setup	
RIP Direction	Select the RIP direction from **None**, **Both**, **In Only** and **Out Only**.
RIP Version	Select the RIP version from **RIP-1**, **RIP-2B** and **RIP-2M**.
Multicast	IGMP (Internet Group Multicast Protocol) is a network-layer protocol used to establish membership in a multicast group. The WiMAX Modem supports both IGMP version 1 (**IGMP-v1**) and **IGMP-v2**. Select **None** to disable it.
Windows Networking (NetBIOS over TCP/IP)	
Allow between LAN and WAN	Select this check box to forward NetBIOS packets from the LAN to the WAN and from the WAN to the LAN. If your firewall is enabled with the default policy set to block WAN to LAN traffic, you also need to enable the default WAN to LAN firewall rule that forwards NetBIOS traffic. Clear this check box to block all NetBIOS packets going from the LAN to the WAN and from the WAN to the LAN.
Allow Trigger Dial	Select this option to allow NetBIOS packets to initiate calls.
Apply	Click to save your changes.
Reset	Click to restore your previously saved settings.

9

The VPN Transport Screens

9.1 Overview

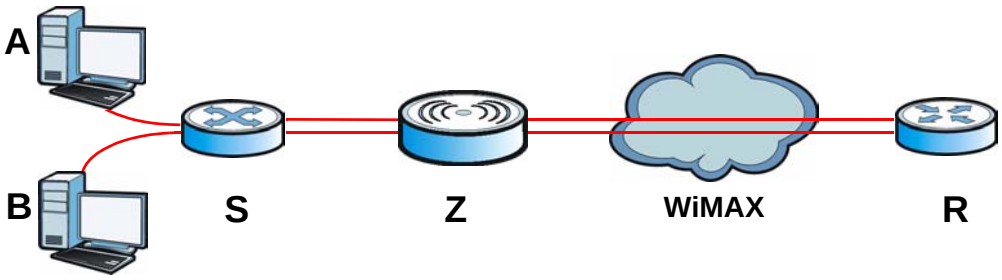
This chapter describes the **ADVANCED > VPN Transport** screens, where you can configure the WiMAX Modem to allow traffic from multiple users to pass through the WiMAX network to the service provider's router. Each user has his own personal connection to the service provider, even though there is only a single WiMAX connection. This allows the service provider to identify which user traffic comes from.

VPN stands for "Virtual Private Network". There are many types of VPN; the type used by the WiMAX Modem is known as Virtual Private LAN Service, or VPLS.

Note: Unlike some other types of VPN (such as IPSec VPNs) VPLS VPNs do not use authentication or encryption to secure the data they carry.

The following figure shows two users (**A** and **B**), connecting to the WiMAX Modem (**Z**) through a switch (**S**). Each user has his own connection over the WiMAX network to the service provider's router (**R**).

Figure 33 VPN Transport Example



Note: The services available may vary, depending upon the service provider.

9.1.1 What You Can Do in This Chapter

- The **General** screen (Section 9.2 on page 99) lets you turn VPN transport on or off, and to set the VPN transport endpoint (your service provider's router).
- The **Customer Interface** screen (Section 9.3 on page 100) lets you specify which users can use which WiMAX network links.

- The **Ethernet Pseudowire** screen (Section 9.4 on page 104) lets you configure the links over the WiMAX network between the WiMAX Modem and the service provider's router.
- The **Statistics** screen (Section 9.5 on page 107) lets you view performance information about the VPN transport connections.

9.1.2 What You Need to Know

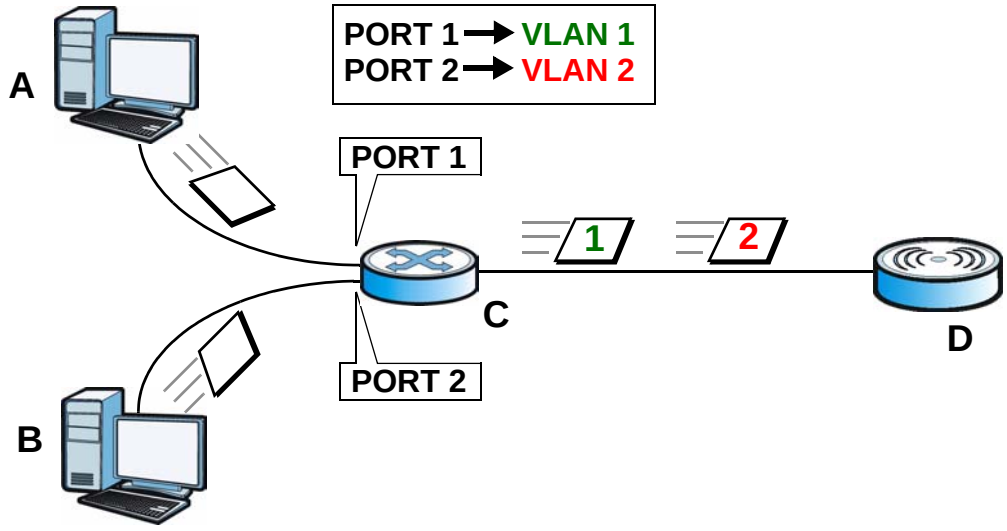
The following terms and concepts may help as you read through this chapter.

Identifying Users

For the WiMAX Modem's VPN Transport feature to work, it must be able to identify users on the LAN. It does this by examining VLAN (Virtual Local Area Network) tags.

These tags must be added to the data packets by a switch on the LAN. In the following example, two users (**A** and **B**) are connected to a switch (**C**). **A** and **B** are connected to different ports on the switch (port 1 and port 2). **A** and **B** send untagged packets to the switch. The switch adds tags to packets depending on the physical port on which they arrive. Packets arriving on port 1 are given a VLAN ID (VLAN IDentifier) of 1, and packets arriving on port 2 are given a VLAN ID of 2. When the packets reach the WiMAX Modem (**D**), their source is identified by examining their VLAN tags.

Figure 34 Identifying Users



9.1.3 Before You Begin

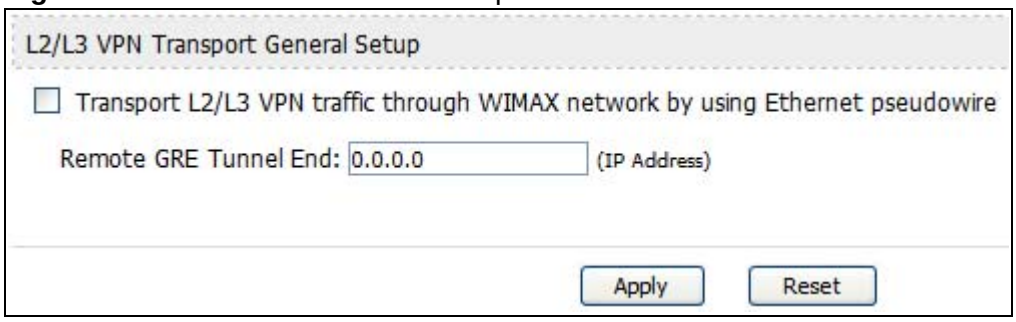
Before you start configuring your WiMAX Modem to use VPN transport, ensure that you have the following from the service provider:

- The IP address or domain name of the service provider's edge router.
- Virtual circuit (VC) labels for each Ethernet Pseudowire you want to create.
- Also make sure that you know the VLAN IDs (Virtual LAN IDentifiers) of the VLANs on your LAN.

9.2 General

Click **ADVANCED > VPN Transport** to turn VPN transport on or off and to set the VPN transport endpoint (your service provider's router).

Figure 35 ADVANCED > VPN Transport > General


L2/L3 VPN Transport General Setup
Transport L2/L3 VPN traffic through WIMAX network by using Ethernet pseudowire
Remote GRE Tunnel End: 0.0.0.0
(IP Address)
Apply
Reset

The following table describes the labels in this screen.

Table 24 ADVANCED > VPN Transport > General

LABEL	DESCRIPTION
L2/L3 VPN Transport General Setup	
Transport L2/L3 VPN...	Select this to turn the VPN transport feature on. Deselect it to turn the VPN transport feature off.
Remote GRE Tunnel End	Enter the domain name or IP address of your service provider's router.
Apply	Click to save your changes.
Reset	Click to restore your previously saved settings.

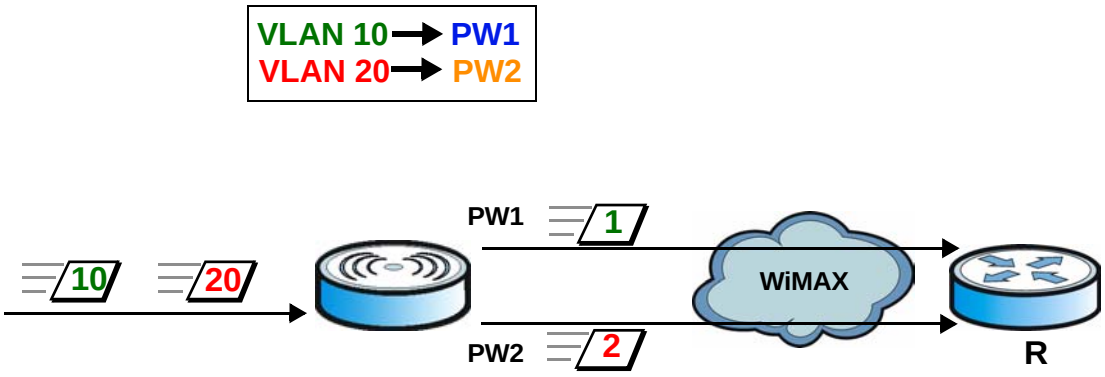
9.3 Customer Interface

Customer interfaces connect data coming from your computers to Ethernet pseudowires, according to the data's VLAN (Virtual Local Area Network) information. One customer interface is for traffic that has no tag; this is the default interface (rule 0) which cannot be deleted in the GUI. All other customer interfaces are identified by their VLAN ID.

Once the WiMAX Modem has examined a frame's VLAN tag, it is able to assign the frame to a specified path. This is done using a customer interface. The customer interface is simply a set of information that takes frames from a VLAN and put them on an Ethernet pseudowire, and vice versa.

In this example, the WiMAX Modem takes frames tagged with two different VLAN IDs (**10** and **20**) and using the customer interfaces, assigns them to specific pseudowires (**PW1** and **PW2**).

Figure 36 Pseudowire Mapping



The WiMAX Modem has a default customer interface configured for frames that arrive at the WiMAX Modem without VLAN tags.

9.3.1 Multi-Protocol Label Switching

The WiMAX Modem uses MPLS VPNs to create virtual private LANs. MPLS stands for Multi-Protocol Label Switching, and is a packet-switching technology that allows packets with different VLAN tags to be transported on different paths (known as LSPs, or Label Switched Paths). Each packet is identified by its VLAN tag and sent to a specific LSP for transport over the WiMAX network.

Each LSP has a defined start-point and end-point. Since MPLS creates mono-directional paths (traffic flows in only one direction), each Ethernet pseudowire uses two LSPs so that traffic can flow both ways. One LSP carries upstream traffic, and the other carries downstream traffic.

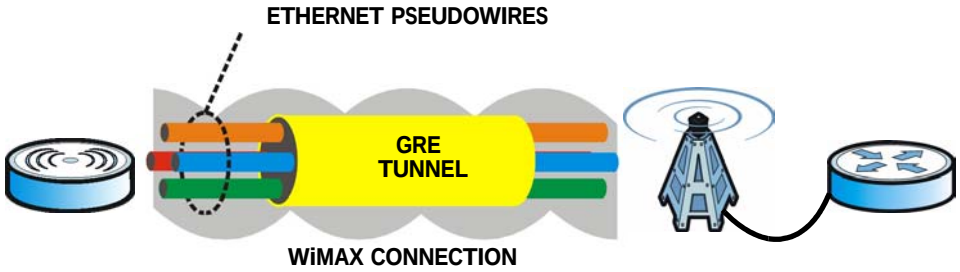
9.3.2 Generic Routing Encapsulation

In order to transport the VPLS traffic over the WiMAX network, the WiMAX Modem uses the Generic Routing Encapsulation (GRE) protocol. Like MPLS, GRE is a tunneling protocol that has specified endpoints. The GRE tunnel is bi-directional, and transports both LSPs. The GRE tunnel runs across the WiMAX network between the WiMAX Modem and your service provider's router.

It is necessary to encapsulate the Ethernet pseudowire since the WiMAX connection is IP-only. MPLS information is carried in a packet's Ethernet header and, without encapsulation, would be stripped from the packet prior to the packet's transmission over the WiMAX link.

The following figure shows the VPLS connection between your WiMAX Modem (**A**) and your service provider's router (**B**), consisting of GRE-encapsulated Ethernet pseudowire traffic.

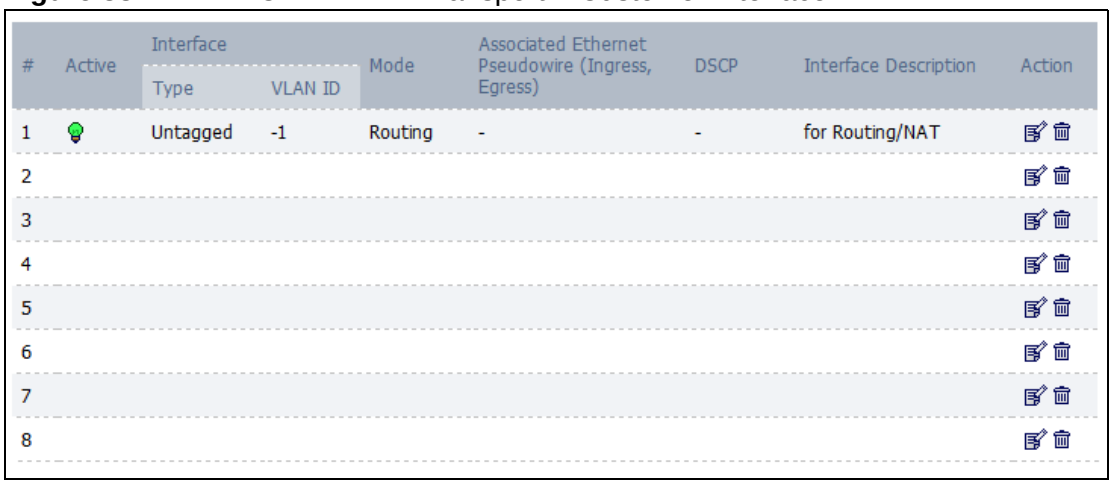
Figure 37 VPLS Tunneling



9.3.3 Customer Interface Options

Click **ADVANCED > VPN Transport** > **Customer Interface** to configure the VPNs used by the WiMAX Modem.

Figure 38 ADVANCED > VPN Transport > Customer Interface



The following table describes the icons in this screen.

Table 25 Advanced> VPN Transport > Customer Interface

ICON	DESCRIPTION
	Edit Click to edit this item.
	Delete Click to delete this item.

The following table describes the labels in this screen.

Table 26 ADVANCED > VPN Transport > Customer Interface

LABEL	DESCRIPTION
#	The number of the item in this list.
Active	This icon is green if the associated interface is enabled. The icon is grey if the associated interface is disabled. Enable or disable an interface by clicking its **Edit** icon and selecting or deselecting **Active** and clicking **Apply** in the screen that displays.
Interface	
Type	This displays either **Tagged** or **Untagged**. A tagged interface controls traffic with a specific IEEE 802.1Q VLAN tag, whereas an untagged interface controls traffic that does not have a VLAN tag. There can be only one untagged interface.
VLAN ID	For a tagged interface, this displays the IEEE 802.1Q VLAN ID number. For the untagged interface, **-1** displays.
Mode	This displays either **B** (bridging) or **R** (routing). Only the default interface, interface 0, can be a routing interface.

Table 26 ADVANCED > VPN Transport > Customer Interface (continued)

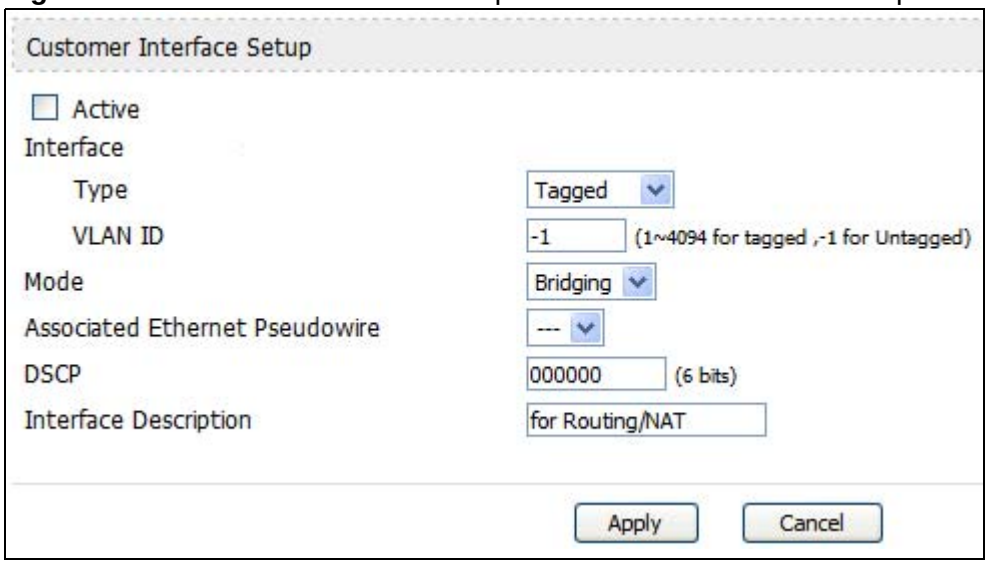
LABEL	DESCRIPTION
Associated Ethernet Pseudowire (Ingress, Egress)	This displays the number of the Ethernet pseudowire that this interface uses, as well as the ingress and egress MPLS (Multi-Protocol Label Switching) VC (Virtual Circuit) label numbers.
DSCP	This displays the DiffServ Control Point value you previously entered in binary. This determines the pseudowire's priority on the network. The DSCP value is displayed in binary notation and has six bits.
Interface Description	This displays the information you previously entered describing the interface. For the default interface, interface 0, the description reads "for routing / NAT".
Action	Click the **Edit** icon to set up a new interface or alter the configuration of an existing interface. Click the **Delete** icon to remove an existing interface.

9.3.4 Customer Interface Setup

Click the **Edit** icon in the **ADVANCED > VPN Transport** > **Customer Interface** screen to open the **Customer Interface Setup**.

Customer interfaces map traffic onto specific Ethernet pseudowires for transport over the WiMAX network. There is also a default customer interface for routing traffic that does not possess a VLAN tag.

Figure 39 ADVANCED > VPN Transport > Customer Interface Setup



The following table describes the labels in this screen.

Table 27 ADVANCED > VPN Transport > Customer Interface Setup

LABEL	DESCRIPTION
Active	Select to make this customer interface active. Deselect it to make the customer interface inactive.
Customer Interface	
Type	A customer interface can be tagged (controlling traffic that has a specific VLAN ID) or untagged (controlling traffic without a specific VLAN ID). There can be only one untagged interface.
VLAN ID	Enter the Virtual Local Area Network Identifier number (1 ~ 4094) for this interface. This VLAN ID must not be used by any other customer interface. For the untagged interface, **-1** displays.
Mode	This displays **Bridging** or **Routing**. A tagged interface can operate in bridging mode only.
Associated Ethernet Pseudowire	Select the Ethernet pseudowire this interface should use for communications over the WiMAX network. You should configure the pseudowire (in the **ADVANCED > VPN Transport** > **Ethernet Pseudowire** screen) before you select it.
DSCP	If you wish to prioritize an interface, enter a DiffServ Code Point value of six bits in binary notation. The higher the value, the higher the interface's priority on the WiMAX Modem's WiMAX link.
Interface Description	Enter a brief (up to 31 characters) name or description for this interface.
Apply	Click to save your changes.
Cancel	Click to return to the previous screen without saving your changes.

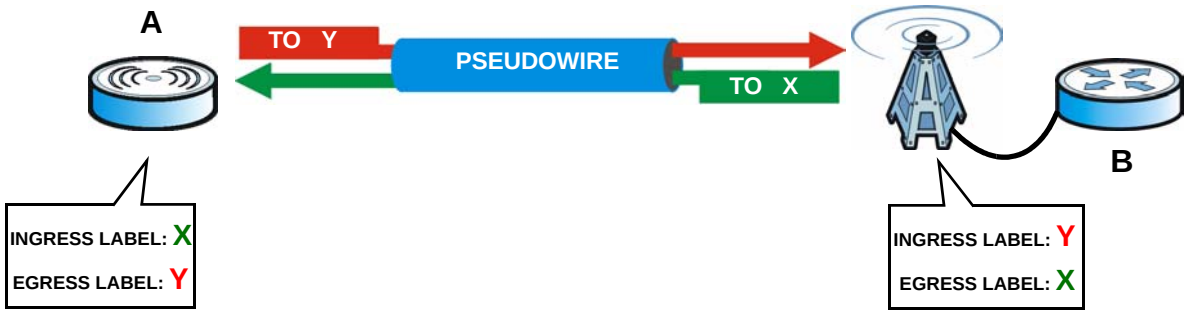
9.4 Ethernet Pseudowire

Because VPLS mimics a simple wired Ethernet connection to your service provider's router, the connection between the WiMAX Modem and the peer device is known as an "Ethernet pseudowire" or "PW".

The Ethernet pseudowires use MPLS (MultiProtocol Label Switching) virtual circuit labels to define the connection. In any such pseudowire, the ingress label on one

device must be the same as the egress label on the peer device, as shown in the following figure. **A** is your WiMAX Modem and **B** is your service provider's router.

Figure 40 Ethernet Pseudowire Settings Example



Click **ADVANCED > VPN Transport** > **Ethernet Pseudowire** to configure the WiMAX Modem's Ethernet pseudowires.

Figure 41 Advance > VPN Transport > Ethernet Pseudowire

The following table describes the icons in this screen.

Table 28 Advanced> VPN Transport > Ethernet Psuedowire

ICON	DESCRIPTION
	Edit Click to edit this item.
	Delete Click to delete this item.

The following table describes the labels in this screen.

Table 29 ADVANCED > VPN Transport > Ethernet Pseudowire

LABEL	DESCRIPTION
#	The number of the item in this list.
Active	This icon is green if the associated pseudowire is enabled. The icon is grey if the associated pseudowire is disabled. Enable or disable a pseudowire by clicking its **Edit** icon.
MPLS VC Label	

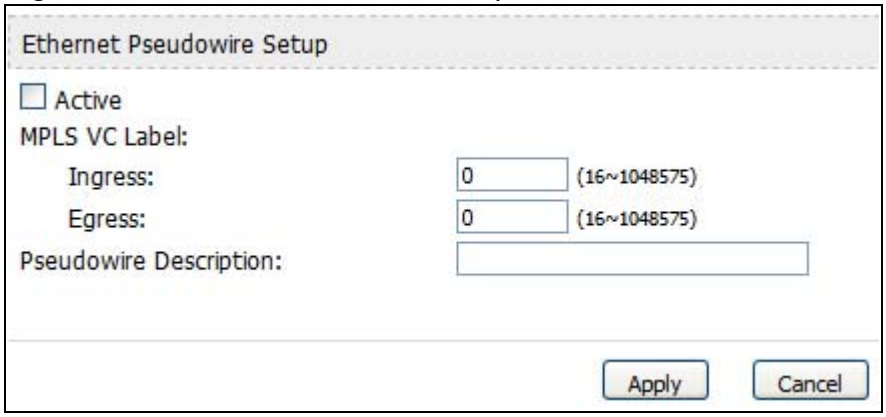
Table 29 ADVANCED > VPN Transport > Ethernet Pseudowire (continued)

LABEL	DESCRIPTION
Ingress	This is the MPLS virtual circuit label number for traffic coming from the peer device.
Egress	This is the MPLS virtual circuit label number for traffic going to the peer device.
Pseudowire Description	This displays the information you previously entered describing the pseudowire.
Action	Click the **Edit** icon to set up an Ethernet pseudowire or alter the configuration of an existing Ethernet pseudowire. Click the **Delete** icon to remove an existing Ethernet pseudowire.

9.4.1 Ethernet Pseudowire Setup

Click a pseudowire entry's **Edit** icon in the **ADVANCED > VPN Transport** > **Ethernet Pseudowire** screen to set up or modify an Ethernet pseudowire's configuration.

Figure 42 ADVANCED > VPN Transport > Ethernet Pseudowire Setup



The following table describes the labels in this screen.

Table 30 ADVANCED > VPN Transport > Ethernet Pseudowire Setup

LABEL	DESCRIPTION
Active	Select this to enable the pseudowire. Deselect it to disable the pseudowire.
MPLS VC Label	
Ingress	Enter the VC ingress label number for this pseudowire. This must be the egress label number of the peer device. This should not be the ingress label number of any other Ethernet pseudowire configured on the WiMAX Modem.
Egress	Enter the egress label number for this pseudowire. This must be the ingress label of the peer device. This should not be the egress label number of any other Ethernet pseudowire configured on the WiMAX Modem.

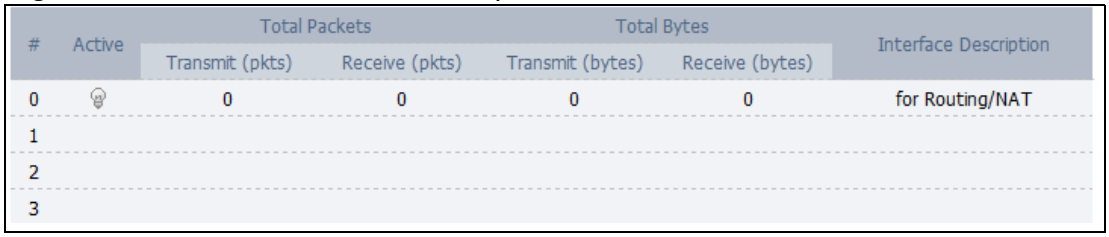
Table 30 ADVANCED > VPN Transport > Ethernet Pseudowire Setup (continued)

LABEL	DESCRIPTION
Pseudowire Description	Enter a brief (up to 31 characters) description for this pseudowire.
Apply	Click to save your changes.
Cancel	Click to return to the previous screen without saving your changes.

9.5 Statistics

Click **ADVANCED > VPN Transport** > **Statistics** to view details and performance information of each active customer interface and its associated Ethernet pseudowire.

Figure 43 ADVANCED > VPN Transport > Statistics



#	Active	Total Packets		Total Bytes		Interface Description
		Transmit (pkts)	Receive (pkts)	Transmit (bytes)	Receive (bytes)	
0		0	0	0	0	for Routing/NAT
1						
2						
3						

The following table describes the labels in this screen.

Table 31 ADVANCED > VPN Transport > Statistics

LABEL	DESCRIPTION
#	The number of the item in this list.
Active	This icon is green if the associated interface is enabled. The icon is grey if the associated interface is disabled. Enable or disable an interface by clicking its **Edit** icon.
Total Packets	This displays the number of packets received (**Receive**) and sent (**Transmit**) on the customer interface since the interface was activated, or the **Clear** button pressed.
Total Bytes	This displays the number of bytes received (**Receive**) and sent (**Transmit**) on the customer interface since the interface was activated, or the **Clear** button pressed.
Interface Description	This is the brief name or description of the customer interface configured in the **ADVANCED > VPN Transport** > **Customer Interface Setup** screen.

10

The NAT Configuration Screens

10.1 Overview

Use these screens to configure port forwarding and trigger ports for the WiMAX Modem. You can also enable and disable SIP, FTP, and H.323 ALG.

Network Address Translation (NAT) maps a host's IP address within one network to a different IP address in another network. For example, you can use a NAT router to map one IP address from your ISP to multiple private IP addresses for the devices in your home network.

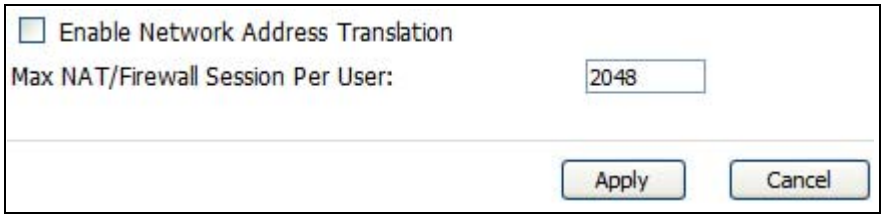
10.1.1 What You Can Do in This Chapter

- The **General** screen (Section 10.2 on page 109) lets you enable or disable NAT and to allocate memory for NAT and firewall rules.
- The **Port Forwarding** screen (Section 10.3 on page 110) lets you look at the current port-forwarding rules in the WiMAX Modem, and to enable, disable, activate, and deactivate each one.
- The **Trigger Port** screen (Section 10.4 on page 114) lets you maintain trigger port forwarding rules for the WiMAX Modem.
- The **ALG** screen (Section 10.5 on page 116) lets you enable and disable SIP (VoIP), FTP (file transfer), and H.323 (audio-visual) ALG in the WiMAX Modem.

10.2 General

Click **ADVANCED > NAT Configuration > General** to enable or disable NAT and to allocate memory for NAT and firewall rules.

Figure 44 ADVANCED > NAT Configuration > General



The following table describes the labels in this screen.

Table 32 ADVANCED > NAT Configuration > General

LABEL	DESCRIPTION
Enable Network Address Translation	Select this if you want to use port forwarding, trigger ports, or any of the ALG.
Max NAT/Firewall Session Per User	When computers use peer to peer applications, such as file sharing applications, they may use a large number of NAT sessions. If you do not limit the number of NAT sessions a single client can establish, this can result in all of the available NAT sessions being used. In this case, no additional NAT sessions can be established, and users may not be able to access the Internet. Each NAT session establishes a corresponding firewall session. Use this field to limit the number of NAT/firewall sessions each client computer can establish through the WiMAX Modem. If your network has a small number of clients using peer to peer applications, you can raise this number to ensure that their performance is not degraded by the number of NAT sessions they can establish. If your network has a large number of users using peer to peer applications, you can lower this number to ensure no single client is using all of the available NAT sessions.
Apply	Click to save your changes.
Cancel	Click to return to the previous screen without saving your changes.

10.3 Port Forwarding

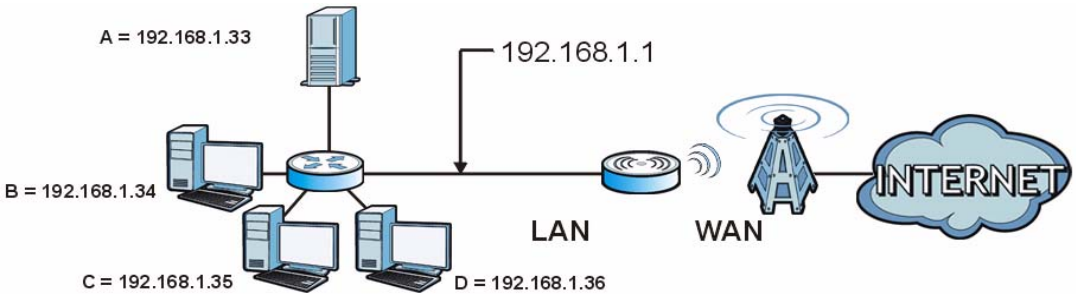
A NAT server set is a list of inside (behind NAT on the LAN) servers, for example, web or FTP, that you can make accessible to the outside world even though NAT makes your whole inside network appear as a single machine to the outside world.

Use the **ADVANCED > NAT Configuration > Port Forwarding** screen to forward incoming service requests to the server(s) on your local network. You may enter a single port number or a range of port numbers to be forwarded, and the local IP address of the desired server. The port number identifies a service; for example, web service is on port 80 and FTP on port 21. In some cases, such as for unknown services or where one server can support more than one service (for example both FTP and web service), it might be better to specify a range of port numbers.

In addition to the servers for specified services, NAT supports a default server. A service request that does not have a server explicitly designated for it is forwarded to the default server. If the default is not defined, the service request is simply discarded.

For example, let's say you want to assign ports 21-25 to one FTP, Telnet and SMTP server (A in the example), port 80 to another (B in the example) and assign a default server IP address of 192.168.1.35 to a third (C in the example). You assign the LAN IP addresses and the ISP assigns the WAN IP address. The NAT network appears as a single host on the Internet.

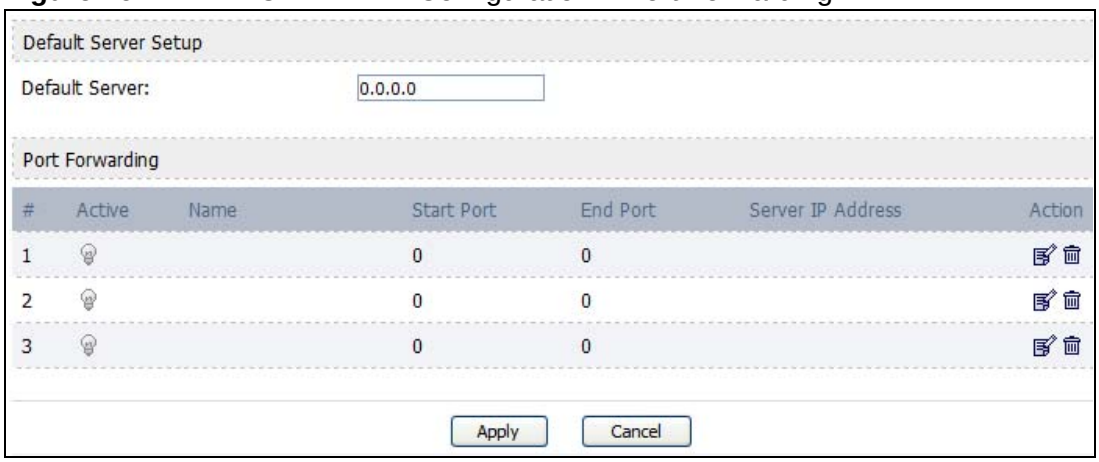
Figure 45 Multiple Servers Behind NAT Example



10.3.1 Port Forwarding Options

Click **ADVANCED > NAT Configuration > Port Forwarding** to look at the current port-forwarding rules in the WiMAX Modem, and to enable, disable, activate, and deactivate each one. You can also set up a default server to handle ports not covered by rules.

Figure 46 ADVANCED > NAT Configuration > Port Forwarding



The following table describes the icons in this screen.

Table 33 Advanced> NAT Configuration > Port Forwarding

ICON	DESCRIPTION
	Edit Click to edit this item.
	Delete Click to delete this item.

The following table describes the labels in this screen.

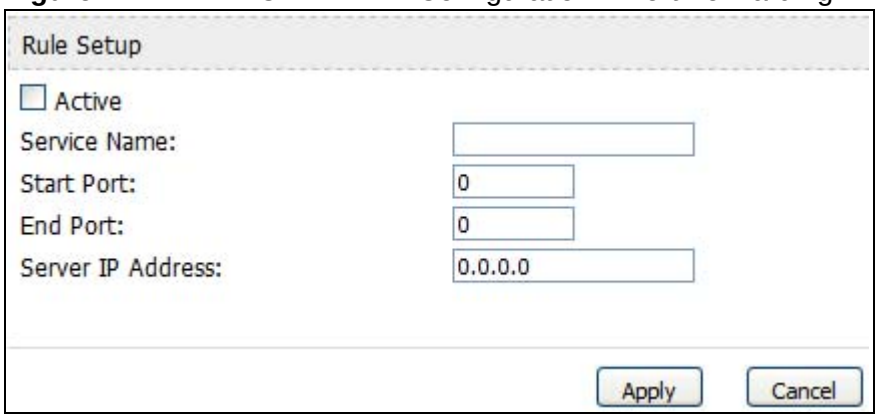
Table 34 ADVANCED > NAT Configuration > Port Forwarding

LABEL	DESCRIPTION
Default Server Setup	
Default Server	Enter the IP address of the server to which the WiMAX Modem should forward packets for ports that are not specified in the **Port Forwarding** section below or in the **TOOLS > Remote MGMT** screens. Enter 0.0.0.0 if you want the WiMAX Modem to discard these packets instead.
Port Forwarding	
#	The number of the item in this list.
Active	Select this to enable this rule. Clear this to disable this rule.
Name	This field displays the name of the rule. It does not have to be unique.
Start Port	This field displays the beginning of the range of port numbers forwarded by this rule.
End Port	This field displays the end of the range of port numbers forwarded by this rule. If it is the same as the **Start Port**, only one port number is forwarded.
Server IP Address	This field displays the IP address of the server to which packet for the selected port(s) are forwarded.
Action	Click the **Edit** icon to set up a port forwarding rule or alter the configuration of an existing port forwarding rule. Click the **Delete** icon to remove an existing port forwarding rule.
Apply	Click to save your changes.
Reset	Click to restore your previously saved settings.

10.3.2 Port Forwarding Rule Setup

Click a port forwarding rule's **Edit** icon in the **ADVANCED > NAT Configuration > Port Forwarding** screen to activate, deactivate, or edit it.

Figure 47 ADVANCED > NAT Configuration > Port Forwarding > Rule Setup



The following table describes the labels in this screen.

Table 35 ADVANCED > NAT Configuration > Port Forwarding > Rule Setup

LABEL	DESCRIPTION
Active	Select this to enable this rule. Clear this to disable this rule.
Service Name	Enter a name to identify this rule. You can use 1 - 31 printable ASCII characters, or you can leave this field blank. It does not have to be a unique name.
Start Port End Port	Enter the port number or range of port numbers you want to forward to the specified server. To forward one port number, enter the port number in the **Start Port** and **End Port** fields. To forward a range of ports, • enter the port number at the beginning of the range in the **Start Port** field • enter the port number at the end of the range in the **End Port** field.
Server IP Address	Enter the IP address of the server to which to forward packets for the selected port number(s). This server is usually on the LAN.
Apply	Click to save your changes.
Cancel	Click to return to the previous screen without saving your changes.

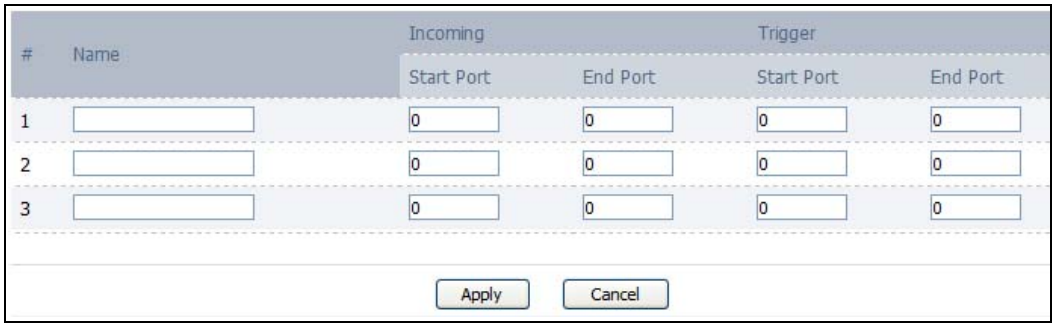
10.4 Trigger Port

Some services use a dedicated range of ports on the client side and a dedicated range of ports on the server side. With regular port forwarding you set a forwarding port in NAT to forward a service (coming in from the server on the WAN) to the IP address of a computer on the client side (LAN). The problem is that port forwarding only forwards a service to a single LAN IP address. In order to use the same service on a different LAN computer, you have to manually replace the LAN computer's IP address in the forwarding port with another LAN computer's IP address,

Trigger port forwarding solves this problem by allowing computers on the LAN to dynamically take turns using the service. The WiMAX Modem records the IP address of a LAN computer that sends traffic to the WAN to request a service with a specific port number and protocol (a "trigger" port). When the WiMAX Modem's WAN port receives a response with a specific port number and protocol ("incoming" port), the WiMAX Modem forwards the traffic to the LAN IP address of the computer that sent the request. After that computer's connection for that service closes, another computer on the LAN can use the service in the same manner. This way you do not need to configure a new IP address each time you want a different LAN computer to use the application.

Click **ADVANCED > NAT Configuration > Trigger Port** to maintain trigger port forwarding rules for the WiMAX Modem.

Figure 48 ADVANCED > NAT Configuration > Trigger Port



The following table describes the labels in this screen.

Table 36 ADVANCED > NAT Configuration > Trigger Port

LABEL	DESCRIPTION
#	The number of the item in this list.
Name	Enter a name to identify this rule. You can use 1 - 15 printable ASCII characters, or you can leave this field blank. It does not have to be a unique name.
Incoming	

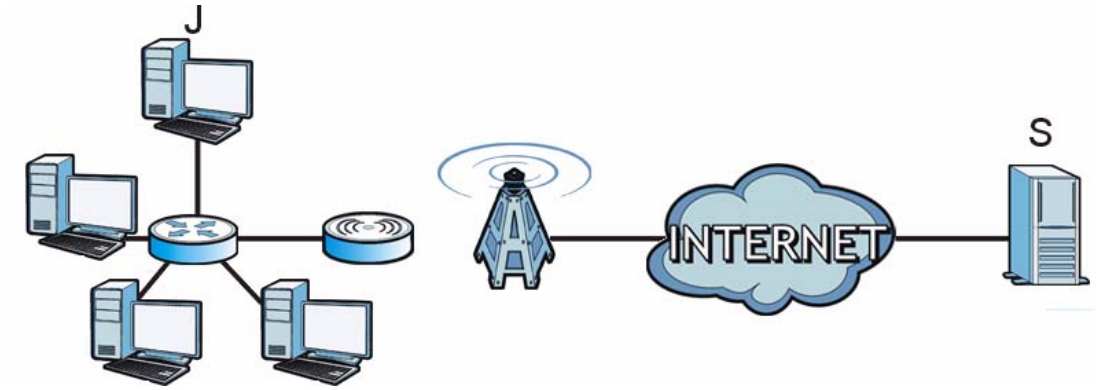
Table 36 ADVANCED > NAT Configuration > Trigger Port (continued)

LABEL	DESCRIPTION
Start Port End Port	Enter the incoming port number or range of port numbers you want to forward to the IP address the WiMAX Modem records. To forward one port number, enter the port number in the **Start Port** and **End Port** fields. To forward a range of ports, • enter the port number at the beginning of the range in the **Start Port** field • enter the port number at the end of the range in the **End Port** field. If you want to delete this rule, enter zero in the **Start Port** and **End Port** fields.
Trigger	
Start Port End Port	Enter the outgoing port number or range of port numbers that makes the WiMAX Modem record the source IP address and assign it to the selected incoming port number(s). To select one port number, enter the port number in the **Start Port** and **End Port** fields. To select a range of ports, • enter the port number at the beginning of the range in the **Start Port** field • enter the port number at the end of the range in the **End Port** field. If you want to delete this rule, enter zero in the **Start Port** and **End Port** fields.
Apply	Click to save your changes.
Cancel	Click to return to the previous screen without saving your changes.

10.4.1 Trigger Port Forwarding Example

The following is an example of trigger port forwarding. In this example, **J** is Jane's computer and **S** is the Real Audio server.

Figure 49 Trigger Port Forwarding Example



1 Jane requests a file from the Real Audio server (port 7070).

2 Port 7070 is a “trigger” port and causes the WiMAX Modem to record Jane’s computer IP address. The WiMAX Modem associates Jane's computer IP address with the "incoming" port range of 6970-7170.

3 The Real Audio server responds using a port number ranging between 6970-7170.

4 The WiMAX Modem forwards the traffic to Jane’s computer IP address.

5 Only Jane can connect to the Real Audio server until the connection is closed or times out. The WiMAX Modem times out in three minutes with UDP (User Datagram Protocol), or two hours with TCP/IP (Transfer Control Protocol/Internet Protocol).

Two points to remember about trigger ports:

1 Trigger events only happen on data that is coming from inside the WiMAX Modem and going to the outside.

2 If an application needs a continuous data stream, that port (range) will be tied up so that another computer on the LAN can’t trigger it.

10.5 ALG

Some applications, such as SIP, cannot operate through NAT (are NAT un-friendly) because they embed IP addresses and port numbers in their packets’ data payload.

Some NAT routers may include a SIP Application Layer Gateway (ALG). An Application Layer Gateway (ALG) manages a specific protocol (such as SIP, H.323 or FTP) at the application layer.

A SIP ALG allows SIP calls to pass through NAT by examining and translating IP addresses embedded in the data stream.

Click **ADVANCED > NAT Configuration > ALG** to enable and disable SIP (VoIP), FTP (file transfer), and H.323 (audio-visual) ALG in the WiMAX Modem.

Figure 50 ADVANCED > NAT Configuration > ALG

The following table describes the labels in this screen.

Table 37 ADVANCED > NAT Configuration > ALG

LABEL	DESCRIPTION
Enable SIP ALG	Select this to make sure SIP (VoIP) works correctly with port-forwarding and port-triggering rules.
Enable FTP ALG	Select this to make sure FTP (file transfer) works correctly with port-forwarding and port-triggering rules.
Enable H.323 ALG	Select this to make sure H.323 (audio-visual programs, such as NetMeeting) works correctly with port-forwarding and port-triggering rules.
Apply	Click to save your changes.
Cancel	Click to return to the previous screen without saving your changes.

11

The System Configuration Screens

11.1 Overview

Click **ADVANCED > System Configuration** to set up general system settings, change the system mode, change the password, configure the DDNS server settings, and set the current date and time.

11.1.1 What You Can Do in This Chapter

- The **General** screen (Section 11.2 on page 121) lets you change the WiMAX Modem's mode, set up its system name, domain name, idle timeout, and administrator password.
- The **Dynamic DNS** screen (Section 11.3 on page 122) lets you set up the WiMAX Modem as a dynamic DNS client.
- The **Firmware** screen (Section 11.4 on page 124) lets you upload new firmware to the WiMAX Modem.
- The **Configuration** screen (Section 11.5 on page 126) lets you back up or restore the configuration of the WiMAX Modem.
- The **Restart** screen (Section 11.6 on page 127) lets you restart your WiMAX Modem from within the web configurator.

11.1.2 What You Need to Know

The following terms and concepts may help as you read through this chapter.

System Name

The **System Name** is often used for identification purposes. Because some ISPs check this name you should enter your computer's "Computer Name".

- In Windows 2000: Click **Start** > **Settings** > **Control Panel** and then double-click the **System** icon. Select the **Network Identification** tab and then click the **Properties** button. Note the entry for the **Computer Name** field and enter it as the **System Name**.

- In Windows XP: Click **Start** > **My Computer** > **View system information** and then click the **Computer Name** tab. Note the entry in the **Full computer name** field and enter it as the WiMAX Modem **System Name**.

Domain Name

The **Domain Name** entry is what is propagated to the DHCP clients on the LAN. If you leave this blank, the domain name obtained by DHCP from the ISP is used. While you must enter the host name (System Name) on each individual computer, the domain name can be assigned from the WiMAX Modem via DHCP.

DNS Server Address Assignment

Use DNS (Domain Name System) to map a domain name to its corresponding IP address and vice versa, for instance, the IP address of www.zyxel.com is 204.217.0.2. The DNS server is extremely important because without it, you must know the IP address of a computer before you can access it.

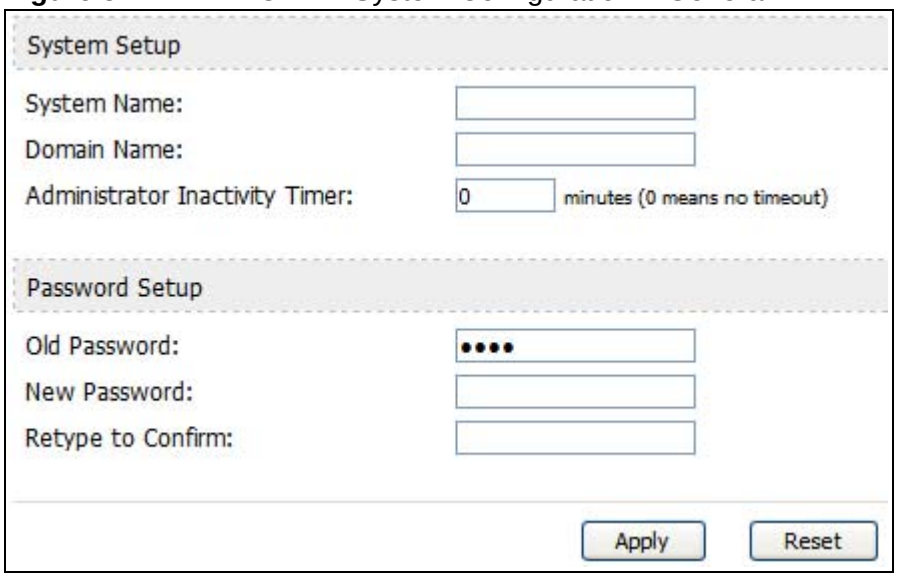
The WiMAX Modem can get the DNS server addresses in the following ways:

1. The ISP tells you the DNS server addresses, usually in the form of an information sheet, when you sign up. If your ISP gives you DNS server addresses, enter them in the **DNS Server** fields in the **SYSTEM General** screen.
2. If the ISP did not give you DNS server information, leave the **DNS Server** fields in the **SYSTEM General** screen set to 0.0.0.0 for the ISP to dynamically assign the DNS server IP addresses.

11.2 General

Click **ADVANCED > System Configuration > General** to change the WiMAX Modem's mode, set up its system name, domain name, idle timeout, and administrator password.

Figure 51 ADVANCED > System Configuration > General



The following table describes the labels in this screen.

Table 38 ADVANCED > System Configuration > General

LABEL	DESCRIPTION
System Setup	
System Name	Enter your computer's "Computer Name". This is for identification purposes, but some ISPs also check this field. This name can be up to 30 alphanumeric characters long. Spaces are not allowed, but dashes "-" and underscores "_" are accepted.
Domain Name	Enter the domain name entry that is propagated to DHCP clients on the LAN. If you leave this blank, the domain name obtained from the ISP is used. Use up to 38 alphanumeric characters. Spaces are not allowed, but dashes "-" and periods "." are accepted.
Administrator Inactivity Timer	Enter the number of minutes a management session can be left idle before the session times out. After it times out, you have to log in again. A value of "0" means a management session never times out, no matter how long it has been left idle. This is not recommended. Long idle timeouts may have security risks. The default is five minutes.
Password Setup	
Old Password	Enter the current password you use to access the WiMAX Modem.
New Password	Enter the new password for the WiMAX Modem. You can use up to 30 characters. As you type the password, the screen displays an asterisk (*) for each character you type.

Table 38 ADVANCED > System Configuration > General (continued)

LABEL	DESCRIPTION
Retype to Confirm	Enter the new password again.
Apply	Click to save your changes.
Reset	Click to restore your previously saved settings.

11.3 Dynamic DNS

Dynamic DNS allows you to update your current dynamic IP address with one or many dynamic DNS services so that anyone can contact you (in NetMeeting, CU-SeeMe, etc.). You can also access your FTP server or Web site on your own computer using a domain name (for instance myhost.dhs.org, where myhost is a name of your choice) that will never change instead of using an IP address that changes each time you reconnect. Your friends or relatives will always be able to call you even if they don't know your IP address.

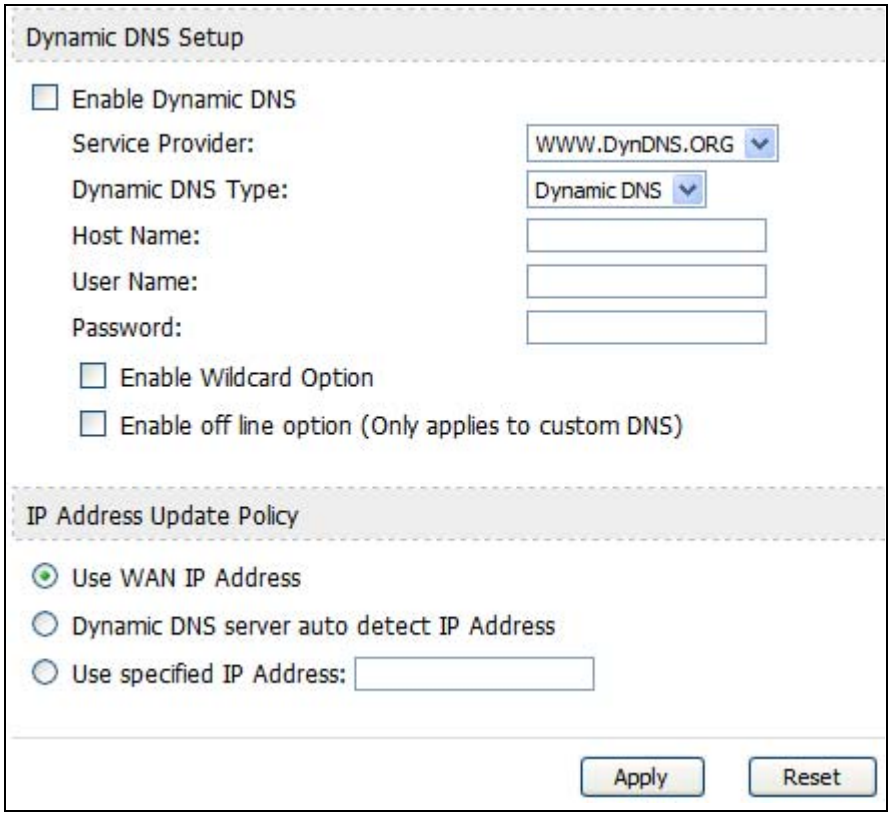
First of all, you need to have registered a dynamic DNS account with www.dyndns.org. This is for people with a dynamic IP from their ISP or DHCP server that would still like to have a domain name. The Dynamic DNS service provider will give you a password or key.

Enabling the wildcard feature for your host causes *.yourhost.dyndns.org to be aliased to the same IP address as yourhost.dyndns.org. This feature is useful if you want to be able to use, for example, www.yourhost.dyndns.org and still reach your hostname.

Note: If you have a private WAN IP address, then you cannot use Dynamic DNS.

Click ADVANCED > System Configuration > Dynamic DNS to set up the WiMAX Modem as a dynamic DNS client.

Figure 52 ADVANCED > System Configuration > Dynamic DNS



The following table describes the labels in this screen.

Table 39 ADVANCED > System Configuration > Dynamic DNS

LABEL	DESCRIPTION
Dynamic DNS Setup	
Enable Dynamic DNS	Select this to use dynamic DNS.
Service Provider	Select the name of your Dynamic DNS service provider.
Dynamic DNS Type	Select the type of service that you are registered for from your Dynamic DNS service provider.
Host Name	Enter the host name. You can specify up to two host names, separated by a comma (",").
User Name	Enter your user name.
Password	Enter the password assigned to you.
Enable Wildcard Option	Select this to enable the DynDNS Wildcard feature.

Table 39 ADVANCED > System Configuration > Dynamic DNS (continued)

LABEL	DESCRIPTION
Enable offline option	This field is available when **CustomDNS** is selected in the **DDNS Type** field. Select this if your Dynamic DNS service provider redirects traffic to a URL that you can specify while you are off line. Check with your Dynamic DNS service provider.
IP Address Update Policy	
Use WAN IP Address	Select this if you want the WiMAX Modem to update the domain name with the WAN port's IP address.
Dynamic DNS server auto detect IP address	Select this if you want the DDNS server to update the IP address of the host name(s) automatically. Select this option when there are one or more NAT routers between the WiMAX Modem and the DDNS server. Note: The DDNS server may not be able to detect the proper IP address if there is an HTTP proxy server between the WiMAX Modem and the DDNS server.
Use specified IP address	Select this if you want to use the specified IP address with the host name(s). Then, specify the IP address. Use this option if you have a static IP address.
Apply	Click to save your changes.
Reset	Click to restore your previously saved settings.

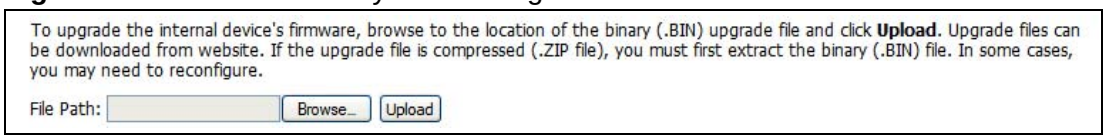
11.4 Firmware

Click **ADVANCED > System Configuration > Firmware** to upload new firmware to the WiMAX Modem. Firmware files usually use the system model name with a "*.bin" extension, such as "WiMAX Modem.bin". The upload process uses HTTP (Hypertext Transfer Protocol) and may take up to two minutes. After a successful upload, the system will reboot.

Contact your service provider for information on available firmware upgrades.

Note: Only use firmware for your WiMAX Modem's specific model.

Figure 53 ADVANCED > System Configuration > Firmware


To upgrade the internal device's firmware, browse to the location of the binary (.BIN) upgrade file and click Upload. Upgrade files can be downloaded from website. If the upgrade file is compressed (.ZIP file), you must first extract the binary (.BIN) file. In some cases, you may need to reconfigure.
File Path:
Browse...
Upload

The following table describes the labels in this screen.

Table 40 ADVANCED > System Configuration > Firmware

LABEL	DESCRIPTION
File Path	Enter the location of the *.bin file you want to upload, or click **Browse...** to find it. You must decompress compressed (.zip) files before you can upload them.
Browse...	Click this to find the *.bin file you want to upload.
Upload	Click this to begin uploading the selected file. This may take up to two minutes. Note: Do not turn off the device while firmware upload is in progress!

11.4.1 The Firmware Upload Process

When the WiMAX Modem uploads new firmware, the process usually takes about two minutes. The device also automatically restarts in this time. This causes a temporary network disconnect.

Note: Do not turn off the device while firmware upload is in progress!

After two minutes, log in again, and check your new firmware version in the **Status** screen. You might have to open a new browser window to log in.

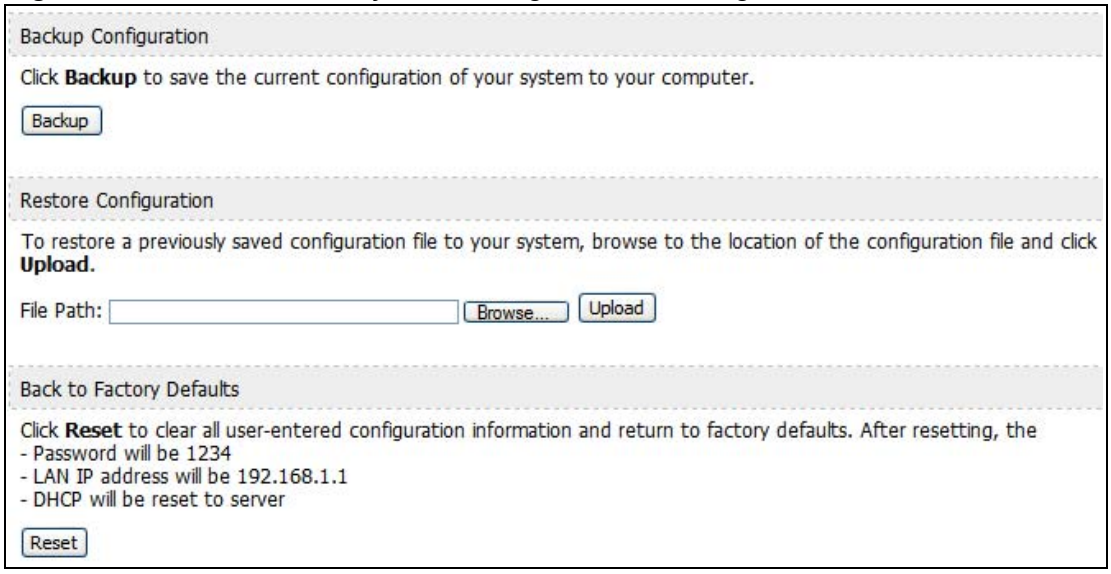
If the upload is not successful, you will be notified by error message.

Click **Return** to go back to the **Firmware** screen.

11.5 Configuration

Click **ADVANCED > System Configuration > Configuration** to back up or restore the configuration of the WiMAX Modem. You can also use this screen to reset the WiMAX Modem to the factory default settings.

Figure 54 ADVANCED > System Configuration > Configuration


Backup Configuration
Click Backup to save the current configuration of your system to your computer.
Backup
Restore Configuration
To restore a previously saved configuration file to your system, browse to the location of the configuration file and click Upload.
File Path:
Browse...
Upload
Back to Factory Defaults
Click Reset to clear all user-entered configuration information and return to factory defaults. After resetting, the
- Password will be 1234
- LAN IP address will be 192.168.1.1
- DHCP will be reset to server
Reset

The following table describes the labels in this screen.

Table 41 ADVANCED > System Configuration > Configuration

LABEL	DESCRIPTION
Backup Configuration	
Backup	Click this to save the WiMAX Modem's current configuration to a file on your computer. Once your device is configured and functioning properly, it is highly recommended that you back up your configuration file before making configuration changes. The backup configuration file is useful if you need to return to your previous settings.
Restore Configuration	
File Path	Enter the location of the file you want to upload, or click **Browse...** to find it.
Browse	Click this to find the file you want to upload.
Upload	Click this to restore the selected configuration file. Note: Do not turn off the device while configuration file upload is in progress.
Back to Factory Defaults	
Reset	Click this to clear all user-entered configuration information and return the WiMAX Modem to its factory defaults. There is no warning screen.

11.5.1 The Restore Configuration Process

When the WiMAX Modem restores a configuration file, the device automatically restarts. This causes a temporary network disconnect.

Note: Do not turn off the device while configuration file upload is in progress.

If the WiMAX Modem's IP address is different in the configuration file you selected, you may need to change the IP address of your computer to be in the same subnet as that of the default management IP address (192.168.5.1). See the Quick Start Guide or the appendices for details on how to set up your computer's IP address.

You might have to open a new browser to log in again.

If the upload was not successful, you are notified by **Configuration Upload Error** message:

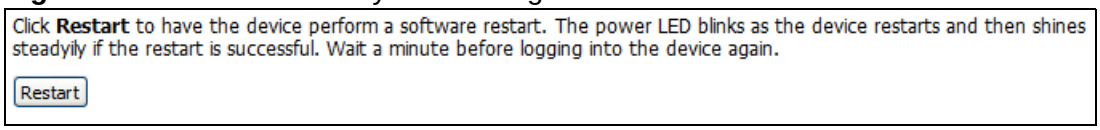
Click **Return** to go back to the **Configuration** screen.

11.6 Restart

Click **ADVANCED > System Configuration > Restart** to reboot the WiMAX Modem without turning the power off.

Note: Restarting the WiMAX Modem does not affect its configuration.

Figure 55 ADVANCED > System Configuration > Restart


Click Restart to have the device perform a software restart. The power LED blinks as the device restarts and then shines steadyily if the restart is successful. Wait a minute before logging into the device again.
Restart

The following table describes the labels in this screen.

Table 42 ADVANCED > System Configuration > Restart

LABEL	DESCRIPTION
Restart	Click this button to have the device perform a software restart. The **Power** LED blinks as it restarts and the shines steadily if the restart is successful. Note: Wait one minute before logging back into the WiMAX Modem after a restart.

11.6.1 The Restart Process

When you click **Restart**, the the process usually takes about two minutes. Once the restart is complete you can log in again.

PART IV
Voice Screens

The Service Configuration Screens (131)

The Phone Screens (149)

The Phone Book Screens (159)

12

The Service Configuration Screens

12.1 Overview

The **VOICE > Service Configuration** screens allow you to set up your voice accounts and configure your QoS settings.

VoIP (Voice over IP) is the sending of voice signals over the Internet Protocol. This allows you to make phone calls and send faxes over the Internet at a fraction of the cost of using the traditional circuit-switched telephone network. You can also use servers to run telephone service applications like PBX services and voice mail. Internet Telephony Service Provider (ITSP) companies provide VoIP service. A company could alternatively set up an IP-PBX and provide it's own VoIP service.

Circuit-switched telephone networks require 64 kilobits per second (kbps) in each direction to handle a telephone call. VoIP can use advanced voice coding techniques with compression to reduce the required bandwidth.

12.1.1 What You Can Do in This Chapter

- The **SIP Settings** screen (Section 12.2 on page 133) lets you setup and maintain your SIP account(s) in the WiMAX Modem.
- The **Advanced SIP Settings** screen (Section 12.2.1 on page 135) lets you set up and maintain advanced settings for each SIP account
- The **QoS** screen (Section 12.3 on page 142) lets you set up and maintain ToS and VLAN settings for the WiMAX Modem.

12.1.2 What You Need to Know

The following terms and concepts may help as you read through this chapter.

SIP

The Session Initiation Protocol (SIP) is an application-layer control (signaling) protocol that handles the setting up, altering and tearing down of voice and

multimedia sessions over the Internet. SIP signaling is separate from the media for which it handles sessions. The media that is exchanged during the session can use a different path from that of the signaling. SIP handles telephone calls and can interface with traditional circuit-switched telephone networks.

SIP Identities

A SIP account uses an identity (sometimes referred to as a SIP address). A complete SIP identity is called a SIP URI (Uniform Resource Identifier). A SIP account's URI identifies the SIP account in a way similar to the way an e-mail address identifies an e-mail account. The format of a SIP identity is SIP-Number@SIP-Service-Domain.

SIP Number

The SIP number is the part of the SIP URI that comes before the “@” symbol. A SIP number can use letters like in an e-mail address (johndoe@your-ITSP.com for example) or numbers like a telephone number (1122334455@VoIP-provider.com for example).

SIP Service Domain

The SIP service domain of the VoIP service provider (the company that lets you make phone calls over the Internet) is the domain name in a SIP URI. For example, if the SIP address is 1122334455@VoIP-provider.com, then “VoIP-provider.com” is the SIP service domain.

SIP Register Server

A SIP register server maintains a database of SIP identity-to-IP address (or domain name) mapping. The register server checks your user name and password when you register.

RTP

When you make a VoIP call using SIP, the RTP (Real time Transport Protocol) is used to handle voice data transfer. See RFC 1889 for details on RTP.

Use NAT

If you know the NAT router’s public IP address and SIP port number, you can use the Use NAT feature to manually configure the WiMAX Modem to use a them in the SIP messages. This eliminates the need for STUN or a SIP ALG. You must also configure the NAT router to forward traffic with this port number to the WiMAX Modem.

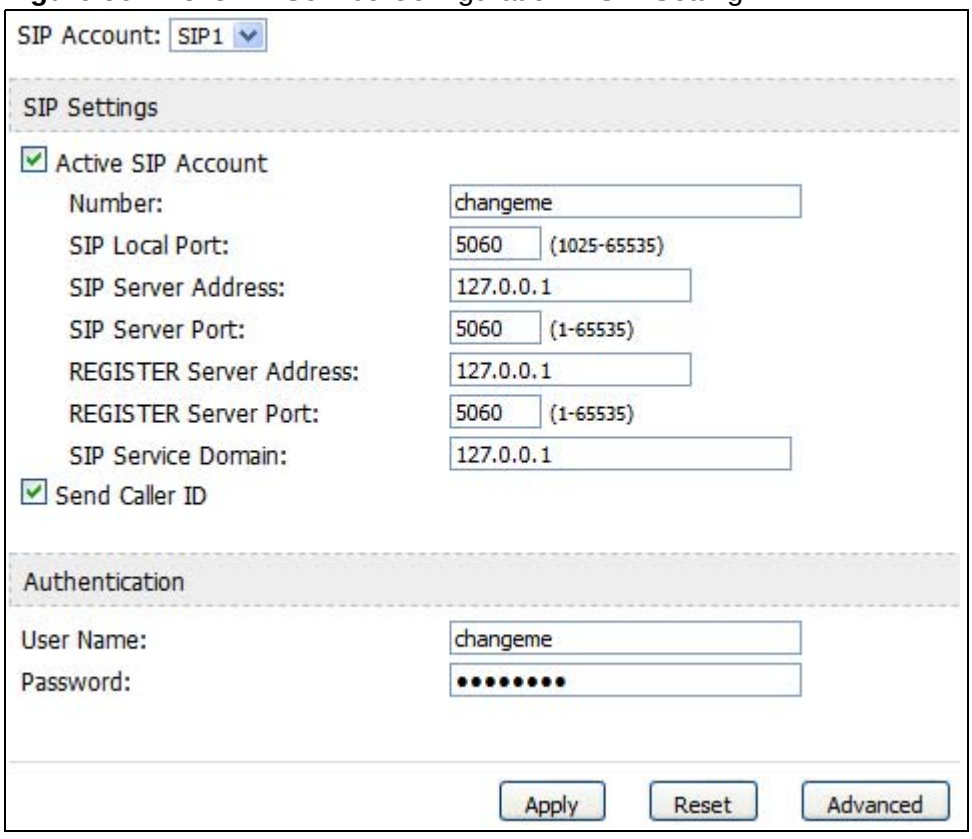
12.1.3 Before you Begin

- Ensure that you have all of your voice account information on hand. If not, contact your voice account service provider to find out which settings in this chapter you should configure in order to use your telephone with the WiMAX Modem.
- Connect your WiMAX Modem to the Internet, as described in the Quick Start Guide. If you have not already done so, then you will not be able to test your VoIP settings.

12.2 SIP Settings

Click **VOICE > Service Configuration > SIP Setting** to setup and maintain your SIP account(s) in the WiMAX Modem. Your VoIP or Internet service provider should provide you with your account information. You can also enable and disable each SIP account.

Figure 56 VOICE > Service Configuration > SIP Setting



The following table describes the labels in this screen.

Table 43 VOICE > Service Configuration > SIP Setting

LABEL	DESCRIPTION
SIP Account	Select the SIP account you want to see in this screen. If you change this field, the screen automatically refreshes.
SIP Settings	
Active SIP Account	Select this if you want the WiMAX Modem to use this account. Clear it if you do not want the WiMAX Modem to use this account.
Number	Enter your SIP number. In the full SIP URI, this is the part before the @ symbol. You can use up to 127 printable ASCII characters.
SIP Local Port	Enter the WiMAX Modem's listening port number, if your VoIP service provider gave you one. Otherwise, keep the default value.
SIP Server Address	Enter the IP address or domain name of the SIP server provided by your VoIP service provider. You can use up to 95 printable ASCII characters. It does not matter whether the SIP server is a proxy, redirect or register server.
SIP Server Port	Enter the SIP server's listening port number, if your VoIP service provider gave you one. Otherwise, keep the default value.
REGISTER Server Address	Enter the IP address or domain name of the SIP register server, if your VoIP service provider gave you one. Otherwise, enter the same address you entered in the **SIP Server Address** field. You can use up to 95 printable ASCII characters.
REGISTER Server Port	Enter the SIP register server's listening port number, if your VoIP service provider gave you one. Otherwise, enter the same port number you entered in the **SIP Server Port** field.
SIP Service Domain	Enter the SIP service domain name. In the full SIP URI, this is the part after the @ symbol. You can use up to 127 printable ASCII Extended set characters.
Send Caller ID	Select this if you want to send identification when you make VoIP phone calls. Clear this if you do not want to send identification.
Authentication	
User Name	Enter the user name for registering this SIP account, exactly as it was given to you. You can use up to 95 printable ASCII characters.
Password	Enter the user name for registering this SIP account, exactly as it was given to you. You can use up to 95 printable ASCII Extended set characters.
Apply	Click to save your changes.
Reset	Click to restore your previously saved settings.
Advanced	Click this to edit the advanced settings for this SIP account. The **Advanced SIP Settings** screen appears.

12.2.1 Advanced SIP Settings

This section describes the features of the Advanced SIP settings screen.

12.2.1.1 STUN

STUN (Simple Traversal of User Datagram Protocol (UDP) through Network Address Translators) allows the WiMAX Modem to find the presence and types of NAT routers and/or firewalls between it and the public Internet. STUN also allows the WiMAX Modem to find the public IP address that NAT assigned, so the WiMAX Modem can embed it in the SIP data stream. STUN does not work with symmetric NAT routers or firewalls. See RFC 3489 for details on STUN.

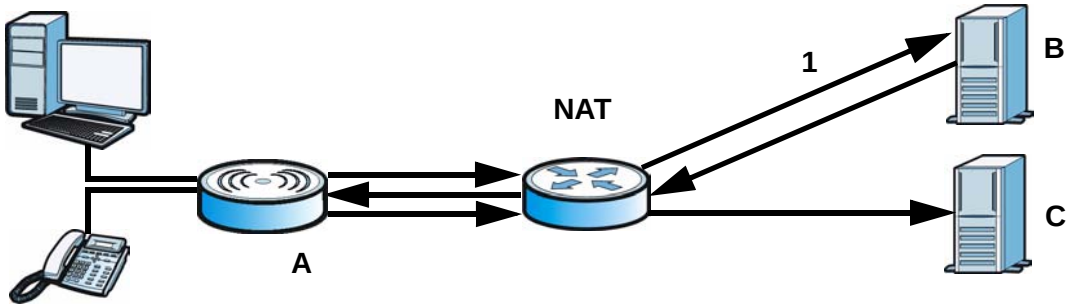
The following figure shows how STUN works.

1 The WiMAX Modem (A) sends SIP packets to the STUN server (B).

2 The STUN server (B) finds the public IP address and port number that the NAT router used on the WiMAX Modem's SIP packets and sends them to the WiMAX Modem.

3 The WiMAX Modem uses the public IP address and port number in the SIP packets that it sends to the SIP server (C).

Figure 57 STUN Example



12.2.1.2 Outbound Proxy

Your VoIP service provider may host a SIP outbound proxy server to handle all of the WiMAX Modem's VoIP traffic. This allows the WiMAX Modem to work with any type of NAT router and eliminates the need for STUN or a SIP ALG. Turn off a SIP ALG on a NAT router in front of the WiMAX Modem to keep it from re-translating the IP address (since this is already handled by the outbound proxy server).

12.2.1.3 Voice Coding

A codec (coder/decoder) codes analog voice signals into digital signals and decodes the digital signals back into voice signals. The WiMAX Modem supports the following codecs.

- **G.711** is a Pulse Code Modulation (PCM) waveform codec. PCM measures analog signal amplitudes at regular time intervals (sampling) and converts them into digital bits (quantization). Quantization “reads” the analog signal and then “writes” it to the nearest digital value. For this reason, a digital sample is usually slightly different from its analog original (this difference is known as “quantization noise”). G.711 provides excellent sound quality but requires 64kbps of bandwidth.
- **G.723** is an Adaptive Differential Pulse Code Modulation (ADPCM) waveform codec. Differential (or Delta) PCM is similar to PCM, but encodes the audio signal based on the difference between one sample and a prediction based on previous samples, rather than encoding the sample’s actual quantized value. Many thousands of samples are taken each second, and the differences between consecutive samples are usually quite small, so this saves space and reduces the bandwidth necessary.

  However, DPCM produces a high quality signal (high signal-to-noise ratio or SNR) for high difference signals (where the actual signal is very different from what was predicted) but a poor quality signal (low SNR) for low difference signals (where the actual signal is very similar to what was predicted). This is because the level of quantization noise is the same at all signal levels. Adaptive DPCM solves this problem by adapting the difference signal’s level of quantization according to the audio signal’s strength. A low difference signal is given a higher quantization level, increasing its signal-to-noise ratio. This provides a similar sound quality at all signal levels. G.723 provides high quality sound and requires 20 or 40 kbps.
- **G.729** is an Analysis-by-Synthesis (AbS) hybrid waveform codec. It uses a filter based on information about how the human vocal tract produces sounds. The codec analyzes the incoming voice signal and attempts to synthesize it using its list of voice elements. It tests the synthesized signal against the original and, if it is acceptable, transmits details of the voice elements it used to make the synthesis. Because the codec at the receiving end has the same list, it can exactly recreate the synthesized audio signal.G.729 provides good sound quality and reduces the required bandwidth to 8kbps.

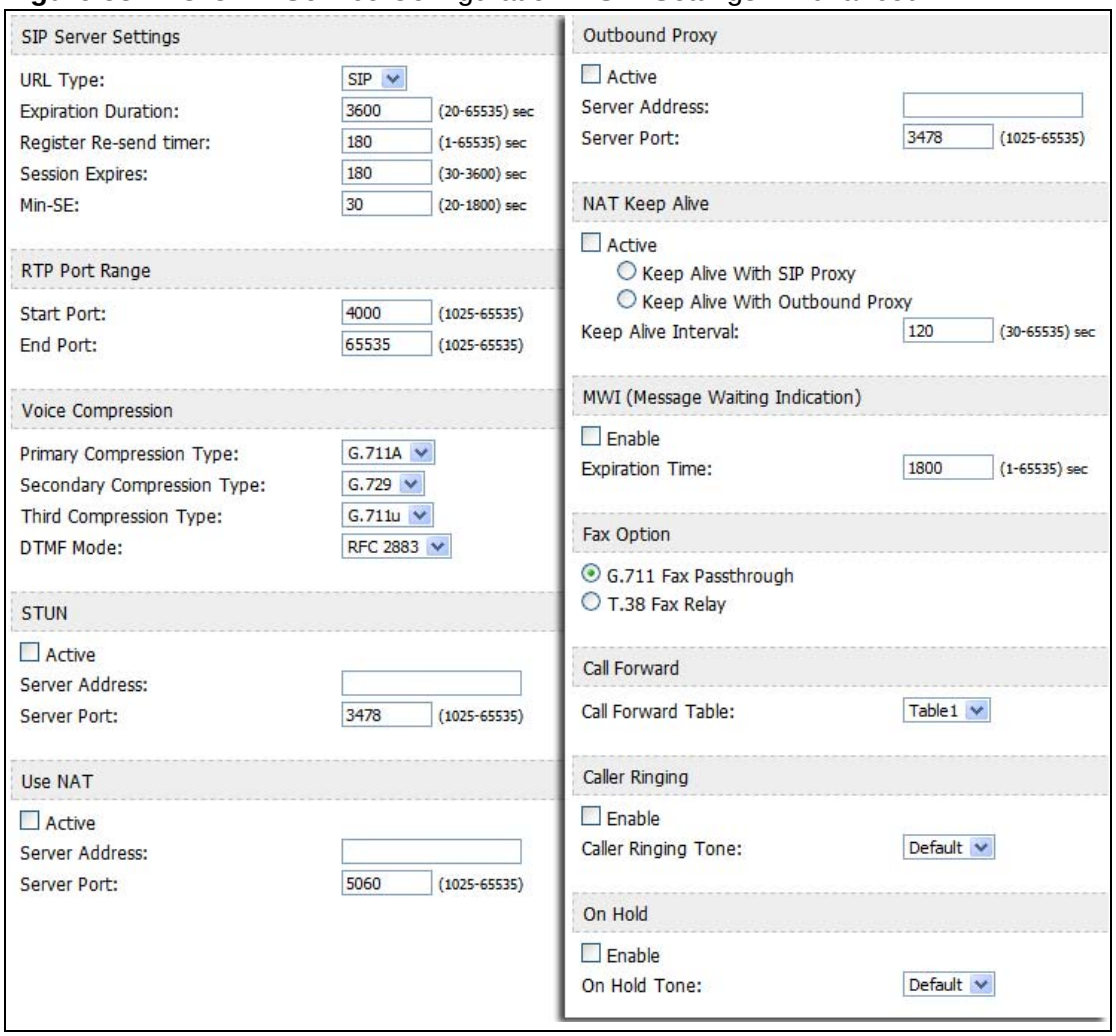
12.2.1.4 MWI (Message Waiting Indication)

Enable Message Waiting Indication (MWI) enables your phone to give you a message–waiting (beeping) dial tone when you have one or more voice messages. Your VoIP service provider must have a messaging system that sends message-waiting-status SIP packets as defined in RFC 3842.

12.2.1.5 Advanced SIP Settings Options

Click **Advanced** in **VOICE > Service Configuration > SIP Settings** to set up and maintain advanced settings for each SIP account.

Figure 58 VOICE > Service Configuration > SIP Settings > Advanced



The following table describes the labels in this screen.

Table 44 VOICE > Service Configuration > SIP Settings > Advanced

LABEL	DESCRIPTION
SIP Server Settings	
URL Type	Select whether or not to include the SIP service domain name when the WiMAX Modem sends the SIP number. • **SIP** - include the SIP service domain name • **TEL** - do not include the SIP service domain name

Table 44 VOICE > Service Configuration > SIP Settings > Advanced (continued)

LABEL	DESCRIPTION
Expiration Duration	Enter the number of seconds your SIP account is registered with the SIP register server before it is deleted. The WiMAX Modem automatically tries to re-register your SIP account when one-half of this time has passed. (The SIP register server might have a different expiration.)
Register Re-send timer	Enter the number of seconds the WiMAX Modem waits before it tries again to register the SIP account, if the first try failed or if there is no response.
Session Expires	Enter the number of seconds the conversation can last before the call is automatically disconnected. Usually, when one-half of this time has passed, the WiMAX Modem or the other party updates this timer to prevent this from happening.
Min-SE	Enter the minimum number of seconds the WiMAX Modem accepts for a session expiration time when it receives a request to start a SIP session. If the request has a shorter time, the WiMAX Modem rejects it.
RTP Port Range	
Start Port End Port	Enter the listening port number(s) for RTP traffic, if your VoIP service provider gave you this information. Otherwise, keep the default values. To enter one port number, enter the port number in the **Start Port** and **End Port** fields. To enter a range of ports: • Type the port number at the beginning of the range in the **Start Port** field • Type the port number at the end of the range in the **End Port** field.
Voice Compression	
Primary, Secondary, and Third Compression	Select the type of voice coder/decoder (codec) that you want the WiMAX Modem to use. G.711 provides high voice quality but requires more bandwidth (64 kbps). • **G.711A** is typically used in Europe. • **G.711u** is typically used in North America and Japan. • **G.723** provides good voice quality, and requires 20 or 40 kbps. • **G.729** requires only 8 kbps. The WiMAX Modem must use the same codec as the peer. When two SIP devices start a SIP session, they must agree on a codec. For more on voice compression, see Voice Coding on page 135
DTMF Mode	Control how the WiMAX Modem handles the tones that your telephone makes when you push its buttons. You should use the same mode your VoIP service provider uses. • **RFC 2833** - send the DTMF tones in RTP packets • **PCM** - send the DTMF tones in the voice data stream. This method works best when you are using a codec that does not use compression (like G.711). Codecs that use compression (like G.729) can distort the tones. • **SIP INFO** - send the DTMF tones in SIP messages

Table 44 VOICE > Service Configuration > SIP Settings > Advanced (continued)

LABEL	DESCRIPTION
STUN	
Active	Select this if all of the following conditions are satisfied. • There is a NAT router between the WiMAX Modem and the SIP server. • The NAT router is not a SIP ALG. • Your VoIP service provider gave you an IP address or domain name for a STUN server. • Otherwise, clear this field.
Server Address	Enter the IP address or domain name of the STUN server provided by your VoIP service provider.
Server Port	Enter the STUN server's listening port, if your VoIP service provider gave you one. Otherwise, keep the default value.
Use NAT	
Active	Select this if you want the WiMAX Modem to send SIP traffic to a specific NAT router. You must also configure the NAT router to forward traffic with the specified port to the WiMAX Modem. This eliminates the need for STUN or a SIP ALG.
Server Address	Enter the public IP address or domain name of the NAT router.
Server Port	Enter the port number that your SIP sessions use with the public IP address of the NAT router.
Outbound Proxy	
Active	Select this if your VoIP service provider has a SIP outbound server to handle voice calls. This allows the WiMAX Modem to work with any type of NAT router and eliminates the need for STUN or a SIP ALG. Turn off any SIP ALG on a NAT router in front of the WiMAX Modem to keep it from re-translating the IP address (since this is already handled by the outbound proxy server).
Server Address	Enter the IP address or domain name of the SIP outbound proxy server.
Server Port	Enter the SIP outbound proxy server's listening port, if your VoIP service provider gave you one. Otherwise, keep the default value.
NAT Keep Alive	
Active	Select this to stop NAT routers between the WiMAX Modem and SIP server (a SIP proxy server or outbound proxy server) from dropping the SIP session. The WiMAX Modem does this by sending SIP notify messages to the SIP server based on the specified interval.
Keep Alive with SIP Proxy	Select this if the SIP server is a SIP proxy server.
Keep Alive with Outbound Proxy	Select this if the SIP server is an outbound proxy server. You must enable **Outbound Proxy** to use this.
Keep Alive Interval	Enter how often (in seconds) the WiMAX Modem should send SIP notify messages to the SIP server.
MWI (Message Waiting Indication)	
Enable	Select this if you want to hear a waiting (beeping) dial tone on your phone when you have at least one voice message. Your VoIP service provider must support this feature.

Table 44 VOICE > Service Configuration > SIP Settings > Advanced (continued)

LABEL	DESCRIPTION
Expiration Time	Keep the default value, unless your VoIP service provider tells you to change it. Enter the number of seconds the SIP server should provide the message waiting service each time the WiMAX Modem subscribes to the service. Before this time passes, the WiMAX Modem automatically subscribes again.
Fax Option	
G.711 Fax Passthrough	Select this if the WiMAX Modem should use G.711 to send fax messages. The peer devices must also use G.711.
T.38 Fax Relay	Select this if the WiMAX Modem should send fax messages as UDP or TCP/IP packets through IP networks. This provides better quality, but it may have inter-operability problems. The peer devices must also use T.38.
Call Forward	
Call Forward Table	Select which call forwarding table you want the WiMAX Modem to use for incoming calls. You set up these tables in **VOICE > Phone Book > Incoming Call Policy**.
Caller Ringing	
Enable	Check this box if you want people to hear a customized recording when they call you.
Caller Ringing Tone	Select the tone you want people to hear when they call you. See Custom Tones (IVR) on page 140 for information on how to record these tones.
On Hold	
Enable	Check this box if you want people to hear a customized recording when you put them on hold.
On Hold Tone	Select the tone you want people to hear when you put them on hold. See Custom Tones (IVR) on page 140 for information on how to record these tones.
Back	Click this to return to the **SIP Settings** screen without saving your changes.
Apply	Click to save your changes.
Reset	Click to restore your previously saved settings.

12.2.1.6 Custom Tones (IVR)

IVR (Interactive Voice Response) is a feature that allows you to use your telephone to interact with the WiMAX Modem. The WiMAX Modem allows you to record custom tones for the **Caller Ringing Tone** and **On Hold Tone** functions. The same recordings apply to both the caller ringing and on hold tones.

Table 45 Custom Tones Details

LABEL	DESCRIPTION
Total Time for All Tones	128 seconds for all custom tones combined

Table 45 Custom Tones Details

LABEL	DESCRIPTION
Maximum Time per Individual Tone	20 seconds
Total Number of Tones Recordable	8 You can record up to eight different custom tones but the total time must be 128 seconds or less.

Use the following steps if you would like to create new tones or change your tones:

1. Pick up the phone and press ******** on your phone's keypad and wait for the message that says you are in the configuration menu.
2. Press a number from 1101~1108 on your phone followed by the **#** key.
3. Play your desired music or voice recording into the receiver's mouthpiece. Press the **#** key.
4. You can continue to add, listen to, or delete tones, or you can hang up the receiver when you are done.

Do the following to listen to a custom tone:

1. Pick up the phone and press ******** on your phone's keypad and wait for the message that says you are in the configuration menu.
2. Press a number from 1201~1208 followed by the **#** key to listen to the tone.
3. You can continue to add, listen to, or delete tones, or you can hang up the receiver when you are done.

Do the following to delete a custom tone:

1. Pick up the phone and press ******** on your phone's keypad and wait for the message that says you are in the configuration menu.
2. Press a number from 1301~1308 followed by the **#** key to delete the tone of your choice. Press 14 followed by the **#** key if you wish to clear all your custom tones.
3. You can continue to add, listen to, or delete tones, or you can hang up the receiver when you are done.

12.3 QoS

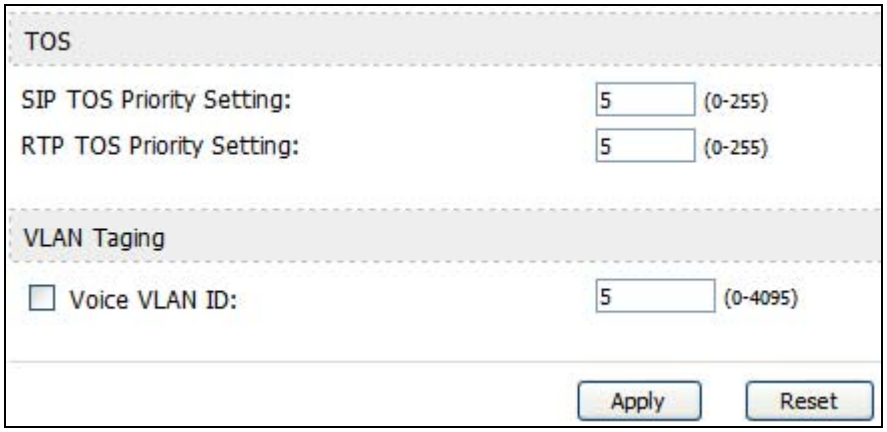
Network traffic can be classified by setting the ToS (Type Of Service) values at the data source (for example, at the WiMAX Modem) so a server can decide the best method of delivery, that is the least cost, fastest route and so on.

Virtual Local Area Network (VLAN) allows a physical network to be partitioned into multiple logical networks. Only stations within the same group can communicate with each other.

Your WiMAX Modem can add IEEE 802.1Q VLAN ID tags to voice frames that it sends to the network. This allows the WiMAX Modem to communicate with a SIP server that is a member of the same VLAN group. Some ISPs use the VLAN tag to identify voice traffic and give it priority over other traffic.

Click **VOICE > Service Configuration > QoS** to set up and maintain ToS and VLAN settings for the WiMAX Modem. QoS (Quality of Service) refers to both a network's ability to deliver data with minimum delay and the networking methods used to provide bandwidth for real-time multimedia applications.

Figure 59 VOICE > Service Configuration > QoS



The following table describes the labels in this screen.

Table 46 VOICE > Service Configuration > QoS

LABEL	DESCRIPTION
TDS	
SIP TOS Priority Setting	Enter the priority for SIP voice transmissions. The WiMAX Modem creates Type of Service priority tags with this priority to voice traffic that it transmits.
RTP TOS Priority Setting	Enter the priority for RTP voice transmissions. The WiMAX Modem creates Type of Service priority tags with this priority to RTP traffic that it transmits.
VLAN Tagging	

Table 46 VOICE > Service Configuration > QoS

LABEL	DESCRIPTION
Voice VLAN ID	Select this if the WiMAX Modem has to be a member of a VLAN to communicate with the SIP server. Ask your network administrator, if you are not sure. Enter the VLAN ID provided by your network administrator in the field on the right. Your LAN and gateway must be configured to use VLAN tags. Otherwise, clear this field.
Apply	Click to save your changes.
Reset	Click to restore your previously saved settings.

12.4 Technical Reference

The following section contains additional technical information about the WiMAX Modem features described in this chapter.

12.4.1 SIP Call Progression

The following figure displays the basic steps in the setup and tear down of a SIP call. A calls B.

Table 47 SIP Call Progression

A		B
1. INVITE		
		2. Ringing
		3. OK
4. ACK		
	5.Dialogue (voice traffic)	
6. BYE		
		7. OK

1. A sends a SIP INVITE request to B. This message is an invitation for B to participate in a SIP telephone call.
2. B sends a response indicating that the telephone is ringing.
3. B sends an OK response after the call is answered.
4. A then sends an ACK message to acknowledge that B has answered the call.
5. Now A and B exchange voice media (talk).

6 After talking, A hangs up and sends a BYE request.

7 B replies with an OK response confirming receipt of the BYE request and the call is terminated.

12.4.2 SIP Client Server

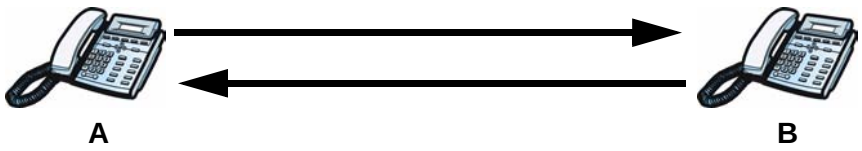
SIP is a client-server protocol. A SIP client is an application program or device that sends SIP requests. A SIP server responds to the SIP requests.

When you use SIP to make a VoIP call, it originates at a client and terminates at a server. A SIP client could be a computer or a SIP phone. One device can act as both a SIP client and a SIP server.

12.4.3 SIP User Agent

A SIP user agent can make and receive VoIP telephone calls. This means that SIP can be used for peer-to-peer communications even though it is a client-server protocol. In the following figure, either A or B can act as a SIP user agent client to initiate a call. A and B can also both act as a SIP user agent to receive the call.

Figure 60 SIP User Agent



12.4.4 SIP Proxy Server

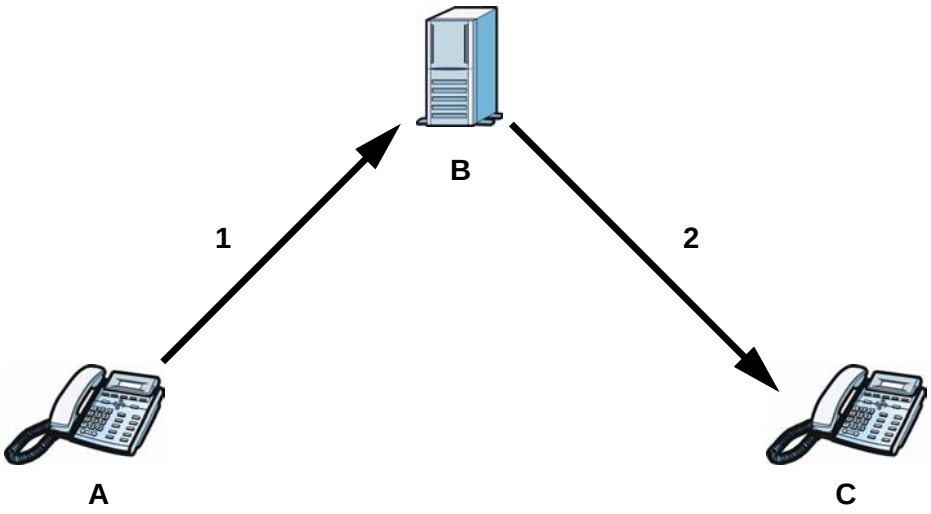
A SIP proxy server receives requests from clients and forwards them to another server.

In the following example, you want to use client device A to call someone who is using client device C.

1 The client device (A in the figure) sends a call invitation to the SIP proxy server (B).

2 The SIP proxy server forwards the call invitation to C.

Figure 61 SIP Proxy Server



12.4.5 SIP Redirect Server

A SIP redirect server accepts SIP requests, translates the destination address to an IP address and sends the translated IP address back to the device that sent the request. Then the client device that originally sent the request can send requests to the IP address that it received back from the redirect server. Redirect servers do not initiate SIP requests.

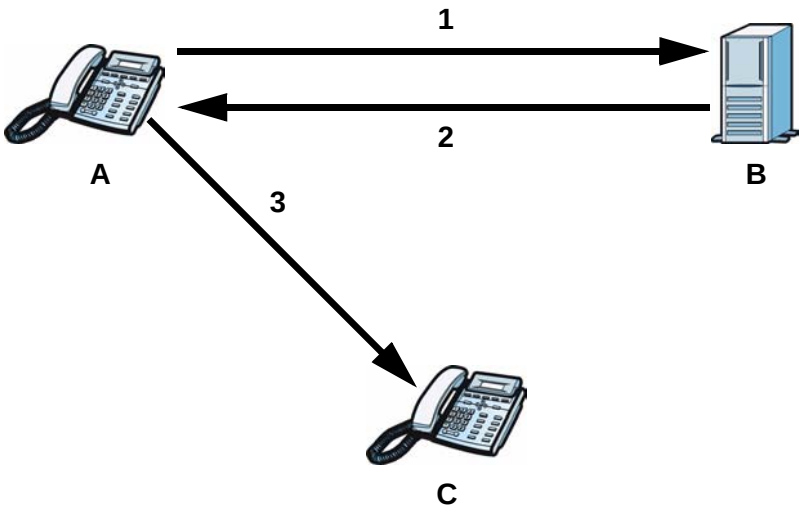
In the following example, you want to use client device A to call someone who is using client device C.

1 Client device A sends a call invitation for C to the SIP redirect server (B).

2 The SIP redirect server sends the invitation back to A with C's IP address (or domain name).

3 Client device A then sends the call invitation to client device C.

Figure 62 SIP Redirect Server



12.4.6 NAT and SIP

The WiMAX Modem must register its public IP address with a SIP register server. If there is a NAT router between the WiMAX Modem and the SIP register server, the WiMAX Modem probably has a private IP address. The WiMAX Modem lists its IP address in the SIP message that it sends to the SIP register server. NAT does not translate this IP address in the SIP message. The SIP register server gets the WiMAX Modem's IP address from inside the SIP message and maps it to your SIP identity. If the WiMAX Modem has a private IP address listed in the SIP message, the SIP server cannot map it to your SIP identity. See Chapter 10 The NAT Configuration Screens for more information.

Use a SIP ALG (Application Layer Gateway), Use NAT, STUN, or outbound proxy to allow the WiMAX Modem to list its public IP address in the SIP messages.

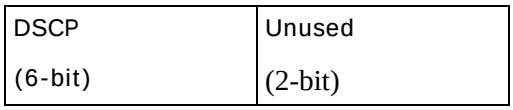
12.4.7 DiffServ

DiffServ is a class of service (CoS) model that marks packets so that they receive specific per-hop treatment at DiffServ-compliant network devices along the route based on the application types and traffic flow. Packets are marked with DiffServ Code Points (DSCPs) indicating the level of service desired. This allows the intermediary DiffServ-compliant network devices to handle the packets differently depending on the code points without the need to negotiate paths or remember state information for every flow. In addition, applications do not have to request a particular service or give advanced notice of where the traffic is going.

12.4.8 DSCP and Per-Hop Behavior

DiffServ defines a new DS (Differentiated Services) field to replace the Type of Service (TOS) field in the IP header. The DS field contains a 2-bit unused field and a 6-bit DSCP field which can define up to 64 service levels. The following figure illustrates the DS field.

Figure 63 DiffServ: Differentiated Service Field



DSCP is backward compatible with the three precedence bits in the ToS octet so that non-DiffServ compliant, ToS-enabled network device will not conflict with the DSCP mapping.

The DSCP value determines the forwarding behavior, the PHB (Per-Hop Behavior), that each packet gets across the DiffServ network. Based on the marking rule, different kinds of traffic can be marked for different priorities of forwarding. Resources can then be allocated according to the DSCP values and the configured policies.

13

The Phone Screens

13.1 Overview

Use the **VOICE > Phone** screens to configure the volume, echo cancellation, VAD settings and custom tones for the phone port on the WiMAX Modem. You can also select which SIP account to use for making outgoing calls.

13.1.1 What You Can Do in This Chapter

- The **Analog Phone** screen (Section 13.2 on page 150) lets you control which SIP accounts each phone uses.
- The **Common** screen (Section 13.3 on page 152) lets you activate and deactivate immediate dialing.
- The **Region** screen (Section 13.4 on page 153) lets you maintain settings that often depend on the region of the world in which the WiMAX Modem is located.

13.1.2 What You Need to Know

The following terms and concepts may help as you read through this chapter.

Voice Activity Detection/Silence Suppression/Comfort Noise

Voice Activity Detection (VAD) detects whether or not speech is present. This lets the WiMAX Modem reduce the bandwidth that a call uses by not transmitting “silent packets” when you are not speaking.

When using VAD, the WiMAX Modem generates comfort noise when the other party is not speaking. The comfort noise lets you know that the line is still connected as total silence could easily be mistaken for a lost connection.

Echo Cancellation

G.168 is an ITU-T standard for eliminating the echo caused by the sound of your voice reverberating in the telephone receiver while you talk.

Supplementary Phone Services Overview

Supplementary services such as call hold, call waiting, call transfer, etc. are generally available from your VoIP service provider. The WiMAX Modem supports the following services:

- Call Hold
- Call Waiting
- Making a Second Call
- Call Transfer
- Call Forwarding
- Three-Way Conference
- Internal Calls
- Caller ID
- CLIP (Calling Line Identification Presentation)
- CLIR (Calling Line Identification Restriction)

Note: To take full advantage of the supplementary phone services available though the WiMAX Modem's phone port, you may need to subscribe to the services from your VoIP service provider.

13.2 Analog Phone

Click **VOICE > Phone > Analog Phone** to control which SIP accounts each phone uses.

Figure 64 VOICE > Phone > Analog Phone

The following table describes the labels in this screen.

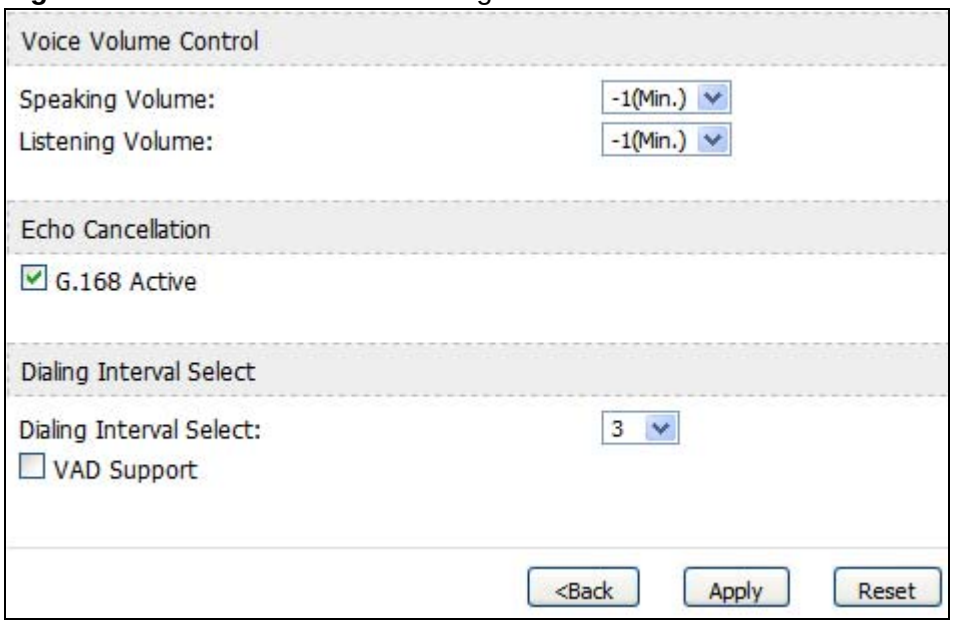
Table 48 VOICE > Phone > Analog Phone

LABEL	DESCRIPTION
Phone Port Settings	Select the phone port you want to see in this screen. If you change this field, the screen automatically refreshes.
Phone Port Settings	Displays the phone port number.
Outgoing Call Use	
SIP1	Select this if you want this phone port to use the SIP1 account when it makes calls. If you select both SIP accounts, the WiMAX Modem tries to use SIP2 first.
Incoming Call apply to	
SIP1	Select this if you want to receive phone calls for the SIP1 account on this phone port. If you select more than one source for incoming calls, there is no way to distinguish between them when you receive phone calls.
Apply	Click to save your changes.
Reset	Click to restore your previously saved settings.
Advanced Setup	Click this to edit the advanced settings for this phone port. The **Advanced Analog Phone Setup** screen appears.

13.2.1 Advanced Analog Phone Setup

Click the **Advanced** button in **VOICE > Phone > Analog Phone** to edit advanced settings for each phone port.

Figure 65 VOICE > Phone > Analog Phone > Advanced



The following table describes the labels in this screen.

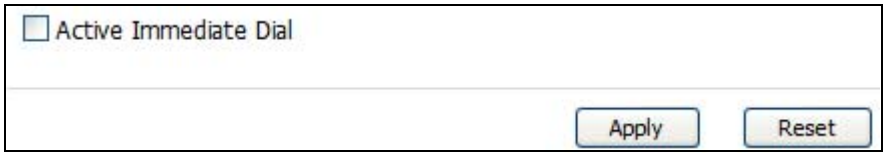
Table 49 VOICE > Phone > Analog Phone > Advanced

LABEL	DESCRIPTION
Voice Volume Control	
Speaking Volume	Enter the loudness that the WiMAX Modem uses for speech that it sends to the peer device. -14 is the quietest, and 14 is the loudest.
Listening Volume	Enter the loudness that the WiMAX Modem uses for speech that it receives from the peer device. -14 is the quietest, and 14 is the loudest.
Echo Cancellation	
G.168 Active	Select this if you want to eliminate the echo caused by the sound of your voice reverberating in the telephone receiver while you talk.
Dialing Interval Select	
Dialing Interval Select	Enter the number of seconds the WiMAX Modem should wait after you stop dialing numbers before it makes the phone call. The value depends on how quickly you dial phone numbers. If you select **Active Immediate Dial** in **VOICE > Phone > Common**, you can press the pound key (#) to tell the WiMAX Modem to make the phone call immediately, regardless of this setting.
VAD Support	Select this if the WiMAX Modem should stop transmitting when you are not speaking. This reduces the bandwidth the WiMAX Modem uses.
Back	Click this to return to the **Analog Phone** screen without saving your changes.
Apply	Click to save your changes.
Reset	Click to restore your previously saved settings.

13.3 Common

Click **VOICE > Phone > Common** to activate and deactivate immediate dialing.

Figure 66 VOICE > Phone > Common



The following table describes the labels in this screen.

Table 50 VOICE > Phone > Common

LABEL	DESCRIPTION
Active Immediate Dial	Select this if you want to use the pound key (#) to tell the WiMAX Modem to make the phone call immediately, instead of waiting the number of seconds you selected in the **Dialing Interval Select** in **VOICE > Phone > Analog Phone**. If you select this, dial the phone number, and then press the pound key if you do not want to wait. The WiMAX Modem makes the call immediately.
Apply	Click to save your changes.
Reset	Click to restore your previously saved settings.

13.4 Region

Click **VOICE > Phone > Region** to maintain settings that often depend on the region of the world in which the WiMAX Modem is located.

Figure 67 VOICE > Phone > Region

The following table describes the labels in this screen.

Table 51 VOICE > Phone > Region

LABEL	DESCRIPTION
Region Settings	Select the place in which the WiMAX Modem is located. Do not select **Default**.
Call Service Mode	Select the mode for supplementary phone services (call hold, call waiting, call transfer and three-way conference calls) that your VoIP service provider supports. • **Europe Type** - use supplementary phone services in European mode • **USA Type** - use supplementary phone services American mode You might have to subscribe to these services to use them. Contact your VoIP service provider.
Apply	Click to save your changes.
Reset	Click to restore your previously saved settings.

13.5 Technical Reference

The following section contains additional technical information about the WiMAX Modem features described in this chapter.

13.5.1 The Flash Key

Flashing means to press the hook for a short period of time (a few hundred milliseconds) before releasing it. On newer telephones, there should be a "flash" key (button) that generates the signal electronically. If the flash key is not available, you can tap (press and immediately release) the hook by hand to achieve the same effect. However, using the flash key is preferred since the timing is much more precise. The WiMAX Modem may interpret manual tapping as hanging up if the duration is too long

You can invoke all the supplementary services by using the flash key.

13.5.2 Europe Type Supplementary Phone Services

This section describes how to use supplementary phone services with the **Europe Type Call Service Mode**. Commands for supplementary services are listed in the table below.

After pressing the flash key, if you do not issue the sub-command before the default sub-command timeout (2 seconds) expires or issue an invalid sub-command, the current operation will be aborted.

Table 52 European Type Flash Key Commands

COMMAND	SUB-COMMAND	DESCRIPTION
Flash		Put a current call on hold to place a second call. Switch back to the call (if there is no second call).
Flash	0	Drop the call presently on hold or reject an incoming call which is waiting for answer.
Flash	1	Disconnect the current phone connection and answer the incoming call or resume with caller presently on hold.
Flash	2	1. Switch back and forth between two calls. 2. Put a current call on hold to answer an incoming call. 3. Separate the current three-way conference call into two individual calls (one is on-line, the other is on hold).
Flash	3	Create three-way conference connection.
Flash	*98#	Transfer the call to another phone.

European Call Hold allows you to put a call (A) on hold by pressing the flash key.

If you have another call, press the flash key and then “2” to switch back and forth between caller **A** and **B** by putting either one on hold.

Press the flash key and then “0” to disconnect the call presently on hold and keep the current call on line.

Press the flash key and then “1” to disconnect the current call and resume the call on hold.

If you hang up the phone but a caller is still on hold, there will be a remind ring.

European Call Waiting allows you to place a call on hold while you answer another incoming call on the same telephone (directory) number.

If there is a second call to a telephone number, you will hear a call waiting tone. Take one of the following actions.

- Reject the second call.

  Press the flash key and then press “0”.
- Disconnect the first call and answer the second call.

  Either press the flash key and press “1”, or just hang up the phone and then answer the phone after it rings.
- Put the first call on hold and answer the second call.

  Press the flash key and then “2”.

European Call Transfer allows you to transfer an incoming call (that you have answered) to another phone. To do so:

1 Press the flash key to put the caller on hold.

2 When you hear the dial tone, dial “*98#” followed by the number to which you want to transfer the call. to operate the Intercom.

3 After you hear the ring signal or the second party answers it, hang up the phone.

European Three-Way Conference allows you to make three-way conference calls. To do so:

1 When you are on the phone talking to someone, place the flash key to put the caller on hold and get a dial tone.

2 Dial a phone number directly to make another call.

3 When the second call is answered, press the flash key and press “3” to create a three-way conversation.

4 Hang up the phone to drop the connection.

5 If you want to separate the activated three-way conference into two individual connections (one is on-line, the other is on hold), press the flash key and press “2”.

13.5.3 USA Type Supplementary Services

This section describes how to use supplementary phone services with the **USA Type Call Service Mode**. Commands for supplementary services are listed in the table below.

After pressing the flash key, if you do not issue the sub-command before the default sub-command timeout (2 seconds) expires or issue an invalid sub-command, the current operation will be aborted.

Table 53 USA Type Flash Key Commands

COMMAND	SUB-COMMAND	DESCRIPTION
Flash		Put a current call on hold to place a second call. After the second call is successful, press the flash key again to have a three-way conference call. Put a current call on hold to answer an incoming call.
Flash	*98#	Transfer the call to another phone.

USA Call Hold allows you to put a call (**A**) on hold by pressing the flash key.

If you have another call, press the flash key to switch back and forth between caller **A** and **B** by putting either one on hold.

If you hang up the phone but a caller is still on hold, there will be a remind ring.

USA Call Waiting allows you to place a call on hold while you answer another incoming call on the same telephone (directory) number.

If there is a second call to your telephone number, you will hear a call waiting tone.

Press the flash key to put the first call on hold and answer the second call.

USA Call Transfer allows you to transfer an incoming call (that you have answered) to another phone. To do so:

1 Press the flash key to put the caller on hold.

2 When you hear the dial tone, dial “*98#” followed by the number to which you want to transfer the call. to operate the Intercom.

3 After you hear the ring signal or the second party answers it, hang up the phone.

USA Three-Way Conference allows you to make three-way conference calls. To do so:

1 When you are making a call, press the flash key to put the call on hold and get a dial tone.

2 Dial a phone number to make a second call.

3 When the second call is answered, press the flash key to create a three-way conversation.

4 If you want to separate the three-way conference into two individual calls (one call is online, the other is on hold), press the flash key. The first call is online and the second call is on hold. Pressing the flash key again will recreate the three-way conversation. The next time you press the flash key, the second call is online and the first call is on hold.

5 Hang up the phone to drop the connection.

14

The Phone Book Screens

14.1 Overview

The **VOICE > Phone Book** screens allow you to configure the WiMAX Modem's phone book for making VoIP calls.

14.1.1 What You Can Do in This Chapter

- The **Incoming Call Policy** screen (Section 14.2 on page 160) lets you maintain rules for handling incoming calls. You can block, redirect, or accept them.
- The **Speed Dial** screen (Section 14.3 on page 162) lets you add, edit, or remove speed-dial entries.

14.1.2 What You Need to Know

The following terms and concepts may help as you read through this chapter.

Speed Dial and Peer-to-Peer Calling

Speed dial provides shortcuts for dialing frequently used (VoIP) phone numbers. It is also required if you want to make peer-to-peer calls.

In peer-to-peer calls, you call another VoIP device directly without going through a SIP server. In the WiMAX Modem, you must set up a speed dial entry in the phone book in order to do this. Select **Non-Proxy (Use IP or URL)** in the **Type** column and enter the callee's IP address or domain name. The WiMAX Modem sends SIP INVITE requests to the peer VoIP device when you use the speed dial entry.

You do not need to configure a SIP account in order to make a peer-to-peer VoIP call.

14.2 Incoming Call Policy

Click **VOICE > Phone Book > Incoming Call Policy** to maintain rules for handling incoming calls. You can block, redirect, or accept them.

Figure 68 VOICE > Phone Book > Incoming Call Policy

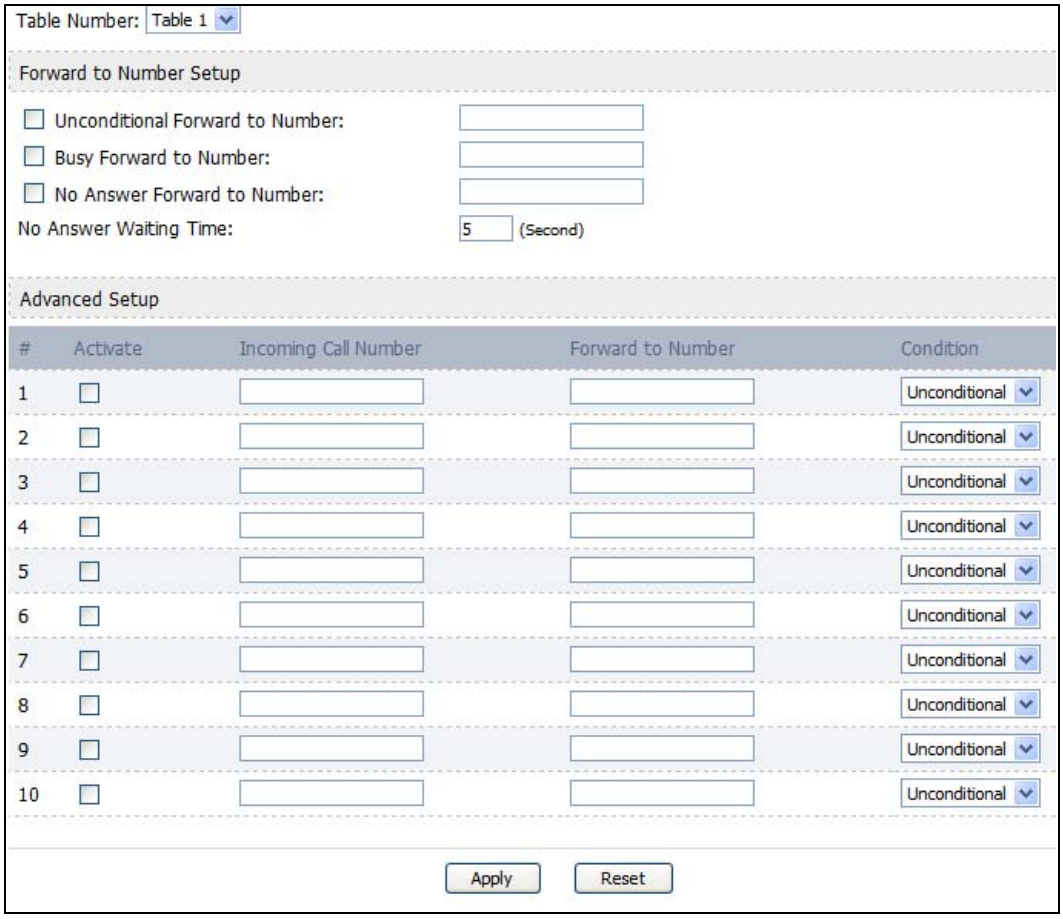


Table Number: Table 1
Forward to Number Setup
Unconditional Forward to Number:
Busy Forward to Number:
No Answer Forward to Number:
No Answer Waiting Time: 5 (Second)
Advanced Setup
Activate Incoming Call Number Forward to Number Condition
1 2 3 4 5 6 7 8 9 10
Unconditional
Apply
Reset

The following table describes the labels in this screen.

Table 54 VOICE > Phone Book > Incoming Call Policy

LABEL	DESCRIPTION
Table Number	Select the call-forwarding table you want to see in this screen. If you change this field, the screen automatically refreshes.
Forward to Number Setup	
Unconditional Forward to Number	Select this if you want the WiMAX Modem to forward all incoming calls to the specified phone number, regardless of other rules in the **Forward to Number** section. Specify the phone number in the field on the right.
Busy Forward to Number	Select this if you want the WiMAX Modem to forward incoming calls to the specified phone number if the phone port is busy. Specify the phone number in the field on the right. If you have call waiting, the incoming call is forwarded to the specified phone number if you reject or ignore the second incoming call.

Table 54 VOICE > Phone Book > Incoming Call Policy

LABEL	DESCRIPTION
No Answer Forward to Number	Select this if you want the WiMAX Modem to forward incoming calls to the specified phone number if the call is unanswered. (See **No Answer Waiting Time**.) Specify the phone number in the field on the right.
No Answer Waiting Time	This field is used by the **No Answer Forward to Number** feature and **No Answer** conditions below. Enter the number of seconds the WiMAX Modem should wait for you to answer an incoming call before it considers the call is unanswered.
Advanced Setup	
#	The number of the item in this list.
Activate	Select this to enable this rule. Clear this to disable this rule.
Incoming Call Number	Enter the phone number to which this rule applies.
Forward to Number	Enter the phone number to which you want to forward incoming calls from the **Incoming Call Number**. You may leave this field blank, depending on the **Condition**.
Condition	Select the situations in which you want to forward incoming calls from the **Incoming Call Number**, or select an alternative action. • **Unconditional** - The WiMAX Modem immediately forwards any calls from the **Incoming Call Number** to the **Forward to Number**. • **Busy -** The WiMAX Modem forwards any calls from the **Incoming Call Number** to the **Forward to Number** when your SIP account already has a call connected. • **No Answer -** The WiMAX Modem forwards any calls from the **Incoming Call Number** to the **Forward to Number** when the call is unanswered. (See **No Answer Waiting Time**.) • **Block -** The WiMAX Modem rejects calls from the **Incoming Call Number**. • **Accept -** The WiMAX Modem allows calls from the **Incoming Call Number**. You might create a rule with this condition if you do not want incoming calls from someone to be forwarded by rules in the **Forward to Number** section.
Apply	Click to save your changes.
Reset	Click to restore your previously saved settings.

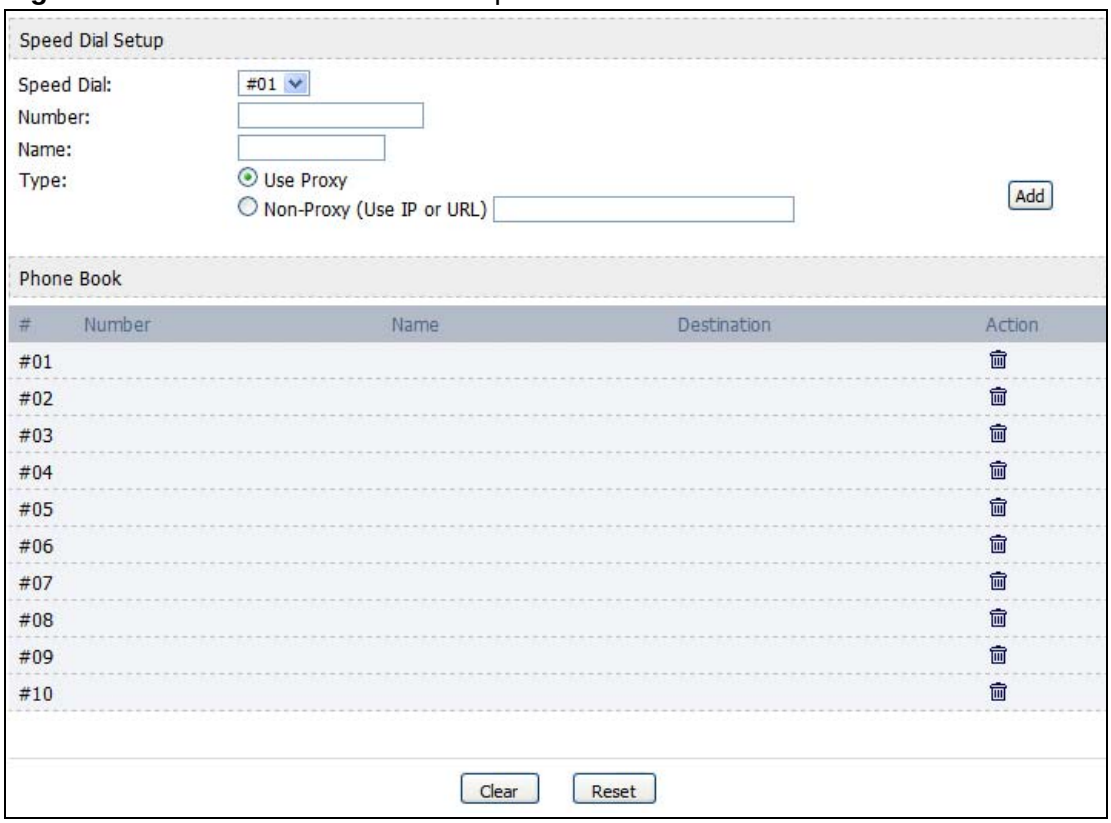
Note: The WiMAX Modem checks the Advanced rules first before checking the Forward to Number rules. All rules are checked in order from top to bottom.

14.3 Speed Dial

Click **VOICE > Phone Book > Speed Dial** to add, edit, or remove speed-dial entries.

You must create speed-dial entries if you want to make peer-to-peer calls or call SIP numbers that use letters. You can also create speed-dial entries for frequently-used SIP phone numbers.

Figure 69 VOICE > Phone Book > Speed Dial



The following table describes the icons in this screen.

Table 55 VOICE > Phone Book > Speed Dial Setup

ICON	DESCRIPTION
	Delete Click to delete this item.

The following table describes the labels in this screen.

Table 56 VOICE > Phone Book > Speed Dial

LABEL	DESCRIPTION
Speed Dial	Select the speed-dial number you want to use for this phone number.
Number	Enter the SIP number you want the WiMAX Modem to call when you dial the speed-dial number.
Name	Enter a name to identify the party you call when you dial the speed-dial number. You can use up to 127 printable ASCII characters.
Type	Select **Use Proxy** if you want to use one of your SIP accounts to call this phone number. Select **Non-Proxy (Use IP or URL)** if you want to use a different SIP server or if you want to make a peer-to-peer call. In this case, enter the IP address or domain name of the SIP server or the other party in the field below.
Add	Click to add the new number to the list below.
#	This is a list of speed dial numbers.
Number	This is the SIP number the WiMAX Modem calls when you use this speed dial number.
Name	This is the name of the party associated with this speed-dial number.
Type	This indicates whether this speed dial number uses a proxy or not when placing a call to the phone number associated with it.
Destination	This indicates if the speed-dial entry uses one of your SIP accounts or uses the IP address or domain name of the SIP server.
Action	Click the **Delete** icon to erase this speed-dial entry.
Apply	Click to save your changes.
Clear	Click to clear all fields on the screen and begin anew.

PART V
Tools & Status Screens

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15

The Certificates Screens

15.1 Overview

Use the **TOOLS > Certificates** screens to manage public key certificates on the WiMAX Modem.

The WiMAX Modem can use public key certificates (also sometimes called “digital IDs”) to authenticate users. Certificates are based on public-private key pairs. A certificate contains the certificate owner’s identity and public key. Certificates provide a way to exchange public keys for use in authentication.

Public key certificates are used by web browsers to ensure that a secure web site is legitimate. When a certificate authority such as VeriSign, Comodo, or Network Solutions (to name a few) receives a certificate request from a website operator, they confirm that the web domain and contact information in the request match those on public record with a domain name registrar. If they match, then the certificate is issued to the website operator, who then places it on his site to be issued to all visiting web browsers to let them know that the site is legitimate.

15.1.1 What You Can Do in This Chapter

- The **My Certificates** screen (Section 15.2 on page 168) lets you generate and export self-signed certificates or certification requests and import the WiMAX Modem’s CA-signed certificates.
- The **Trusted CAs** screen (Section 15.3 on page 178) lets you display a summary list of certificates of the certification authorities that you have set the WiMAX Modem to accept as trusted.

15.1.2 What You Need to Know

The following terms and concepts may help as you read through this chapter.

Certificate Authorities

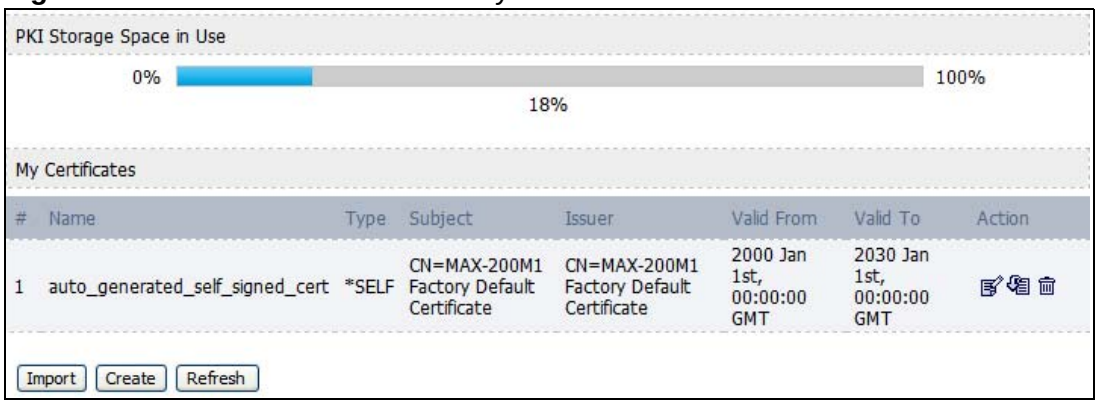
A Certification Authority (CA) issues certificates and guarantees the identity of each certificate owner. There are commercial certification authorities like CyberTrust or VeriSign and government certification authorities. You can use the

WiMAX Modem to generate certification requests that contain identifying information and public keys and then send the certification requests to a certification authority.

15.2 My Certificates

Click **TOOLS > Certificates > My Certificates** to access this screen. Use this screen to generate and export self-signed certificates or certification requests and import the WiMAX Modem's CA-signed certificates.

Figure 70 TOOLS > Certificates > My Certificates


PKI Storage Space in Use
0%
100%
18%
My Certificates
Name Type Subject Issuer Valid From Valid To Action
1 auto_generated_self_signed_cert *SELF CN=MAX-200M1 Factory Default Certificate CN=MAX-200M1 Factory Default Certificate 2000 Jan 1st, 00:00:00 GMT 2030 Jan 1st, 00:00:00 GMT
Import
Create
Refresh

The following table describes the icons in this screen.

Table 57 TOOLS > Certificates > My Certificates

ICON	DESCRIPTION
	Edit Click to edit this item.
	Export Click to export an item.
	Delete Click to delete this item.

The following table describes the labels in this screen.

Table 58 TOOLS > Certificates > My Certificates

LABEL	DESCRIPTION
PKI Storage Space in Use	This bar displays the percentage of the WiMAX Modem's PKI storage space that is currently in use. When the storage space is almost full, you should consider deleting expired or unnecessary certificates before adding more certificates.
#	The number of the item in this list.

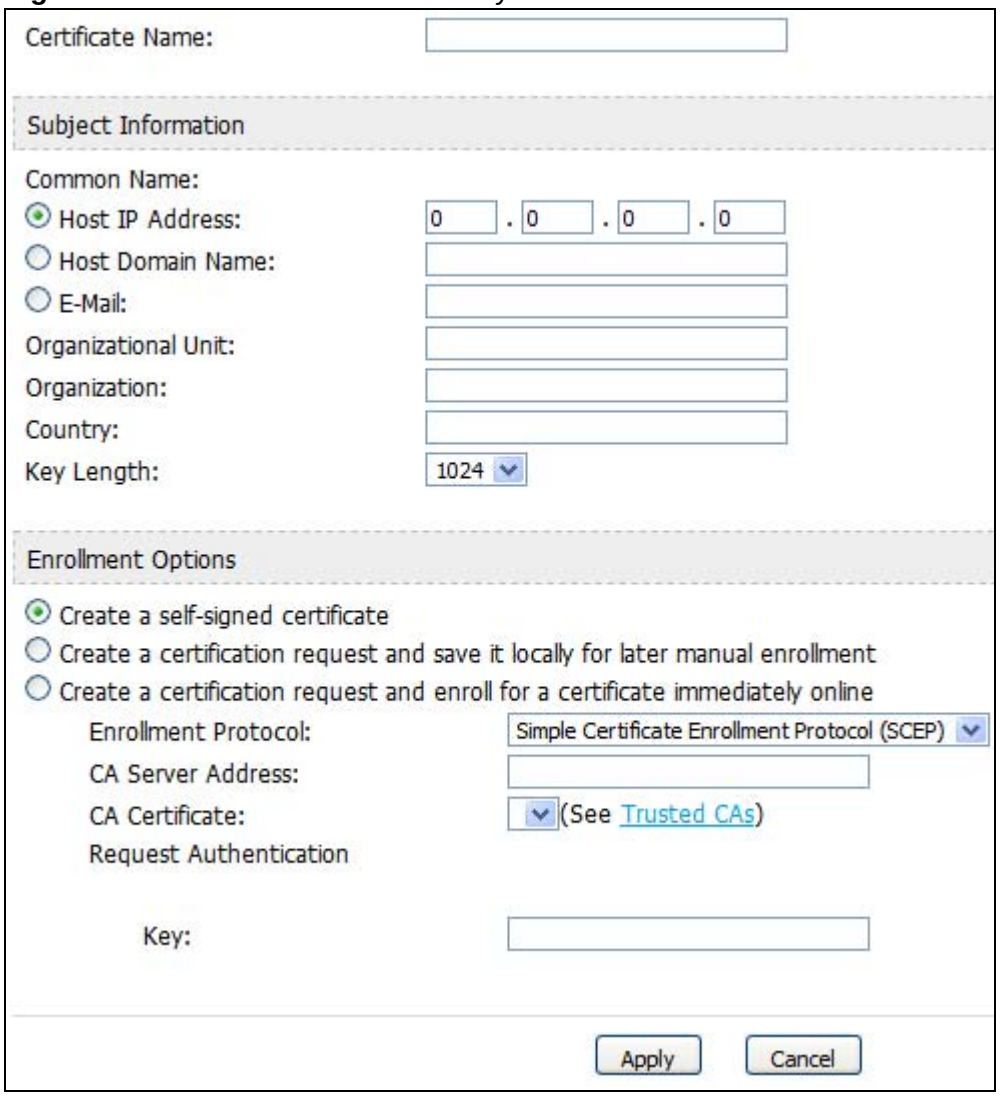
Table 58 TOOLS > Certificates > My Certificates (continued)

LABEL	DESCRIPTION
Name	This field displays the name used to identify this certificate. It is recommended that you give each certificate a unique name.
Type	This field displays what kind of certificate this is. **REQ** represents a certification request and is not yet a valid certificate. Send a certification request to a certification authority, which then issues a certificate. Use the **My Certificate Import** screen to import the certificate and replace the request. **SELF** represents a self-signed certificate. ***SELF** represents the default self-signed certificate which signs the imported remote host certificates. **CERT** represents a certificate issued by a certification authority.
Subject	This field displays identifying information about the certificate's owner, such as CN (Common Name), OU (Organizational Unit or department), O (Organization or company) and C (Country). It is recommended that each certificate have unique subject information.
Issuer	This field displays identifying information about the certificate's issuing certification authority, such as a common name, organizational unit or department, organization or company and country. With self-signed certificates, this is the same information as in the **Subject** field.
Valid From	This field displays the date that the certificate becomes applicable.
Valid To	This field displays the date that the certificate expires. The text displays in red and includes an Expired! message if the certificate has expired.
Action	Click the **Edit** icon to open a screen with an in-depth list of information about the certificate. Click the **Export** icon to save a copy of the certificate without its private key. Browse to the location you want to use and click **Save**. Click the **Delete** icon to remove a certificate. A window displays asking you to confirm that you want to delete the certificate. Subsequent certificates move up by one when you take this action. The WiMAX Modem keeps all of your certificates unless you specifically delete them. Uploading new firmware or default configuration file does not delete your certificates. You cannot delete certificates that any of the WiMAX Modem's features are configured to use.
Import	Click to a certificate into the WiMAX Modem.
Create	Click to go to the screen where you can have the WiMAX Modem generate a certificate or a certification request.
Refresh	Click to display the current validity status of the certificates.

15.2.1 My Certificates Create

Click **TOOLS > Certificates > My Certificates** and then the **Create** icon to open the **My Certificates Create** screen. Use this screen to have the WiMAX Modem create a self-signed certificate, enroll a certificate with a certification authority or generate a certification request.

Figure 71 TOOLS > Certificates > My Certificates > Create



The following table describes the labels in this screen.

Table 59 TOOLS > Certificates > My Certificates > Create

LABEL	DESCRIPTION
Certificate Name	Type a name to identify this certificate. You can use up to 31 alphanumeric and ;'~!@#$%^&()_+[]{}',.=- characters.
Subject Information	Use these fields to record information that identifies the owner of the certificate. You do not have to fill in every field, although the **Common Name** is mandatory. The certification authority may add fields (such as a serial number) to the subject information when it issues a certificate. It is recommended that each certificate have unique subject information.
Common Name	Select a radio button to identify the certificate's owner by IP address, domain name or e-mail address. Type the IP address (in dotted decimal notation), domain name or e-mail address in the field provided. The domain name or e-mail address is for identification purposes only and can be any string. A domain name can be up to 255 characters. You can use alphanumeric characters, the hyphen and periods. An e-mail address can be up to 63 characters. You can use alphanumeric characters, the hyphen, the @ symbol, periods and the underscore.
Organizational Unit	Identify the organizational unit or department to which the certificate owner belongs. You can use up to 63 characters. You can use alphanumeric characters, the hyphen and the underscore.
Organization	Identify the company or group to which the certificate owner belongs. You can use up to 63 characters. You can use alphanumeric characters, the hyphen and the underscore.
Country	Identify the state in which the certificate owner is located. You can use up to 31 characters. You can use alphanumeric characters, the hyphen and the underscore.
Key Length	Select a number from the drop-down list box to determine how many bits the key should use (512 to 2048). The longer the key, the more secure it is. A longer key also uses more PKI storage space.
Enrollment Options	These radio buttons deal with how and when the certificate is to be generated.
Create a self-signed certificate	Select **Create a self-signed certificate** to have the WiMAX Modem generate the certificate and act as the Certification Authority (CA) itself. This way you do not need to apply to a certification authority for certificates.
Create a certification request and save it locally for later manual enrollment	Select **Create a certification request and save it locally for later manual enrollment** to have the WiMAX Modem generate and store a request for a certificate. Use the **My Certificate Details** screen to view the certification request and copy it to send to the certification authority. Copy the certification request from the **My Certificate Details** screen and then send it to the certification authority.

Table 59 TOOLS > Certificates > My Certificates > Create

LABEL	DESCRIPTION
Create a certification request and enroll for a certificate immediately online	Select **Create a certification request and enroll for a certificate immediately online** to have the WiMAX Modem generate a request for a certificate and apply to a certification authority for a certificate. You must have the certification authority's certificate already imported in the **Trusted CAs** screen. When you select this option, you must select the certification authority's enrollment protocol and the certification authority's certificate from the drop-down list boxes and enter the certification authority's server address. You also need to fill in the **Reference Number** and **Key** if the certification authority requires them.
Enrollment Protocol	This field applies when you select **Create a certification request and enroll for a certificate immediately online**. Select the certification authority's enrollment protocol from the drop-down list box. **Simple Certificate Enrollment Protocol (SCEP)** is a TCP-based enrollment protocol that was developed by VeriSign and Cisco. **Certificate Management Protocol (CMP)** is a TCP-based enrollment protocol that was developed by the Public Key Infrastructure X.509 working group of the Internet Engineering Task Force (IETF) and is specified in RFC 2510.
CA Server Address	This field applies when you select **Create a certification request and enroll for a certificate immediately online**. Enter the IP address (or URL) of the certification authority server. For a URL, you can use up to 511 of the following characters. a-zA-Z0-9'()+,/:.=?;!*#@$_%-
CA Certificate	This field applies when you select **Create a certification request and enroll for a certificate immediately online**. Select the certification authority's certificate from the **CA Certificate** drop-down list box. You must have the certification authority's certificate already imported in the **Trusted CAs** screen. Click **Trusted CAs** to go to the **Trusted CAs** screen where you can view (and manage) the WiMAX Modem's list of certificates of trusted certification authorities.
Request Authentication	When you select **Create a certification request and enroll for a certificate immediately online**, the certification authority may want you to include a reference number and key to identify you when you send a certification request. Fill in both the **Reference Number** and the **Key** fields if your certification authority uses CMP enrollment protocol. Just the **Key** field displays if your certification authority uses the SCEP enrollment protocol. For the reference number, use 0 to 99999999. For the key, use up to 31 of the following characters. a-zA-Z0-9;|`~!@#$%^&*()_+\{}':,./<>=-

Table 59 TOOLS > Certificates > My Certificates > Create

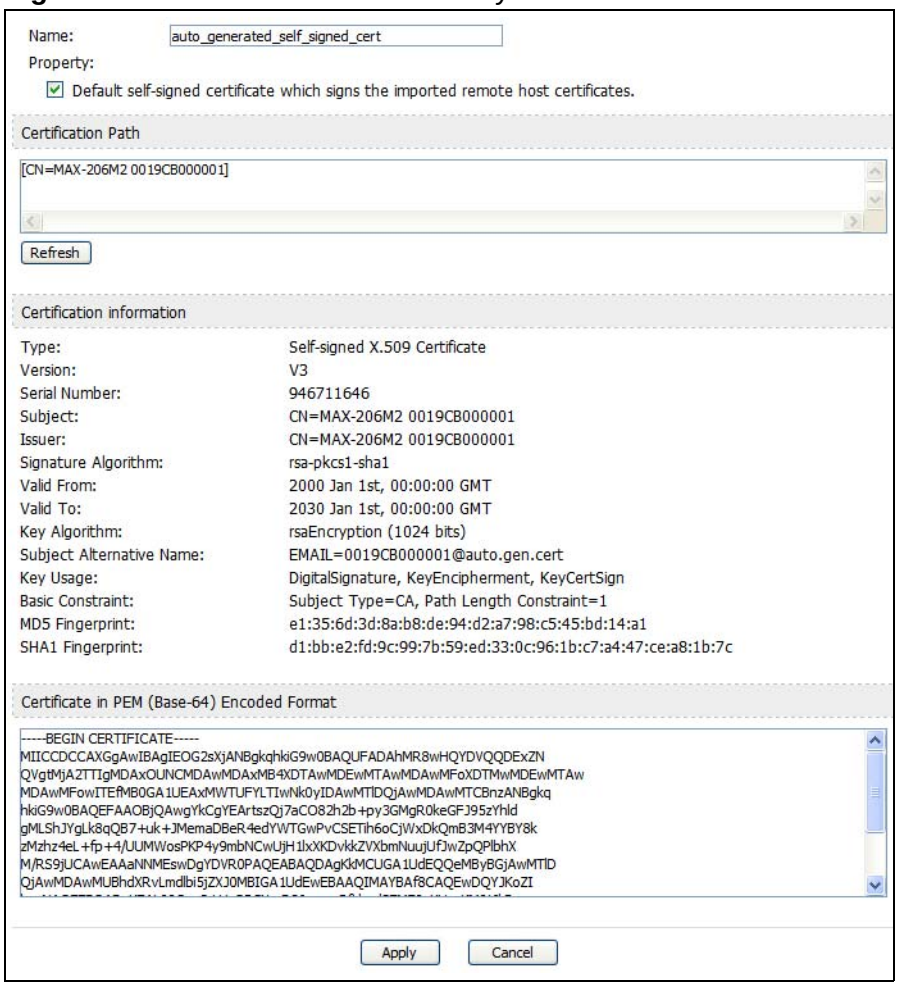
LABEL	DESCRIPTION
Apply	Click to save your changes.
Cancel	Click to return to the previous screen without saving your changes.

If you configured the **My Certificate Create** screen to have the WiMAX Modem enroll a certificate and the certificate enrollment is not successful, you see a screen with a **Return** button that takes you back to the **My Certificate Create** screen. Click **Return** and check your information in the **My Certificate Create** screen. Make sure that the certification authority information is correct and that your Internet connection is working properly if you want the WiMAX Modem to enroll a certificate online.

15.2.2 My Certificate Edit

Click **TOOLS > Certificates > My Certificates** then the **Edit** icon to access this screen. Use this screen to view in-depth certificate information and change the certificate's name.

Figure 72 TOOLS > Certificates > My Certificates > Edit



The following table describes the labels in this screen.

Table 60 TOOLS > Certificates > My Certificates > Edit

LABEL	DESCRIPTION
Name	This field displays the identifying name of this certificate. You can use up to 31 alphanumeric and ;'~!@#$%^&()_+[]{}',.=- characters.
Property	Select **Default self-signed certificate which signs the imported remote host certificates** to use this certificate to sign the remote host certificates you upload in the **TOOLS > Certificates > Trusted CAs** screen.

Table 60 TOOLS > Certificates > My Certificates > Edit

LABEL	DESCRIPTION
Certification Path	This field displays for a certificate, not a certification request. Click the **Refresh** button to have this read-only text box display the hierarchy of certification authorities that validate the certificate (and the certificate itself). If the issuing certification authority is one that you have imported as a trusted certification authority, it may be the only certification authority in the list (along with the certificate itself). If the certificate is a self-signed certificate, the certificate itself is the only one in the list. The WiMAX Modem does not trust the certificate and displays "Not trusted" in this field if any certificate on the path has expired or been revoked.
Refresh	Click to display the certification path.
Certification Information	
Type	This field displays general information about the certificate. CA-signed means that a Certification Authority signed the certificate. Self-signed means that the certificate's owner signed the certificate (not a certification authority). "X.509" means that this certificate was created and signed according to the ITU-T X.509 recommendation that defines the formats for public-key certificates.
Version	This field displays the X.509 version number. "
Serial Number	This field displays the certificate's identification number given by the certification authority or generated by the WiMAX Modem.
Subject	This field displays information that identifies the owner of the certificate, such as Common Name (CN), Organizational Unit (OU), Organization (O) and Country (C).
Issuer	This field displays identifying information about the certificate's issuing certification authority, such as Common Name, Organizational Unit, Organization and Country. With self-signed certificates, this is the same as the **Subject Name** field. "none" displays for a certification request.
Signature Algorithm	This field displays the type of algorithm that was used to sign the certificate. The WiMAX Modem uses rsa-pkcs1-sha1 (RSA public-private key encryption algorithm and the SHA1 hash algorithm). Some certification authorities may use rsa-pkcs1-md5 (RSA public-private key encryption algorithm and the MD5 hash algorithm).
Valid From	This field displays the date that the certificate becomes applicable. "none" displays for a certification request.
Valid To	This field displays the date that the certificate expires. The text displays in red and includes an Expired! message if the certificate has expired. "none" displays for a certification request.
Key Algorithm	This field displays the type of algorithm that was used to generate the certificate's key pair (the WiMAX Modem uses RSA encryption) and the length of the key set in bits (1024 bits for example).
Subject Alternative Name	This field displays the certificate owner's IP address (IP), domain name (DNS) or e-mail address (EMAIL).

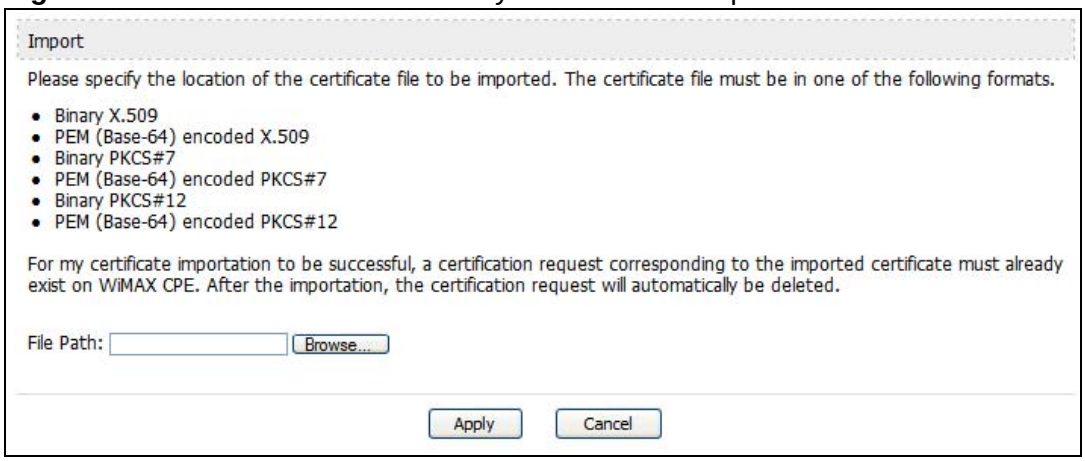
Table 60 TOOLS > Certificates > My Certificates > Edit

LABEL	DESCRIPTION
Key Usage	This field displays for what functions the certificate's key can be used. For example, "DigitalSignature" means that the key can be used to sign certificates and "KeyEncipherment" means that the key can be used to encrypt text.
Basic Constraint	This field displays general information about the certificate. For example, Subject Type=CA means that this is a certification authority's certificate and "Path Length Constraint=1" means that there can only be one certification authority in the certificate's path. This field does not display for a certification request.
MD5 Fingerprint	This is the certificate's message digest that the WiMAX Modem calculated using the MD5 algorithm.
SHA1 Fingerprint	This is the certificate's message digest that the WiMAX Modem calculated using the SHA1 algorithm.
Certificate in PEM (Base-64) Encoded Format	This read-only text box displays the certificate or certification request in Privacy Enhanced Mail (PEM) format. PEM uses lowercase letters, uppercase letters and numerals to convert the binary certificate into a printable form. You can copy and paste a certification request into a certification authority's web page, an e-mail that you send to the certification authority or a text editor and save the file on a management computer for later manual enrollment. You can copy and paste a certificate into an e-mail to send to friends or colleagues or you can copy and paste a certificate into a text editor and save the file on a management computer for later distribution (via floppy disk for example).
Apply	Click to save your changes.
Cancel	Click to return to the previous screen without saving your changes.

15.2.3 My Certificate Import

Click **TOOLS > Certificates > My Certificates > Import** to access this screen. Use this screen to import a certificate that matches a corresponding certification request that was generated by the WiMAX Modem. You must remove any spaces from the certificate's filename before you can import it.

Figure 73 TOOLS > Certificates > My Certificates > Import


Import
Please specify the location of the certificate file to be imported. The certificate file must be in one of the following formats.
Binary X.509
PEM (Base-64) encoded X.509
Binary PKCS#7
PEM (Base-64) encoded PKCS#7
Binary PKCS#12
PEM (Base-64) encoded PKCS#12
For my certificate importation to be successful, a certification request corresponding to the imported certificate must already exist on WiMAX CPE. After the importation, the certification request will automatically be deleted.
File Path:
Browse...
Apply
Cancel

The following table describes the labels in this screen.

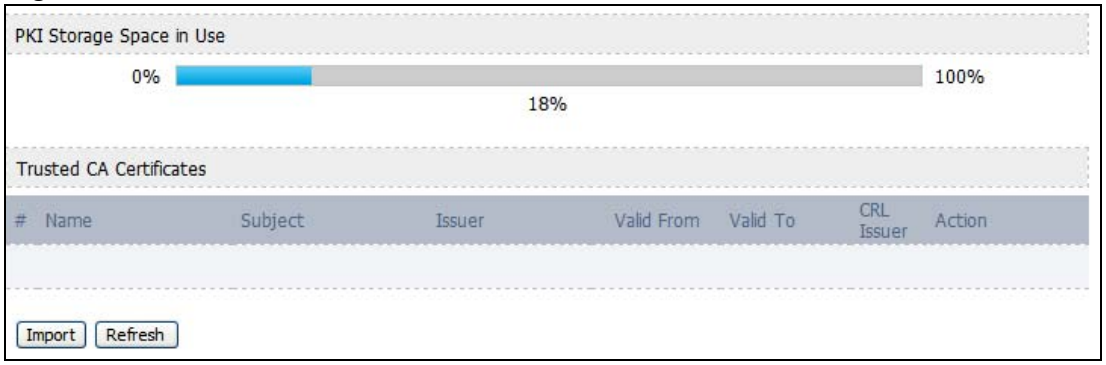
Table 61 TOOLS > Certificates > My Certificates > Import

LABEL	DESCRIPTION
File Path	Type in the location of the file you want to upload in this field or click **Browse** to find it. You cannot import a certificate with the same name as a certificate that is already in the WiMAX Modem.
Browse	Click to find the certificate file you want to upload.
Apply	Click to save your changes.
Cancel	Click to return to the previous screen without saving your changes.

15.3 Trusted CAs

Click **TOOLS > Certificates > Trusted CAs** access this screen. Use this screen to display a summary list of certificates of the certification authorities that you have set the WiMAX Modem to accept as trusted. The WiMAX Modem accepts any valid certificate signed by a certification authority on this list as being trustworthy; thus you do not need to import any certificate that is signed by one of these certification authorities.

Figure 74 TOOLS > Certificates > Trusted CAs



The following table describes the icons in this screen.

Table 62 TOOLS > Certificates > Trusted CAs

ICON	DESCRIPTION
	Edit Click to edit this item.
	Export Click to export an item.
	Delete Click to delete this item.

The following table describes the labels in this screen.

Table 63 TOOLS > Certificates > Trusted CAs

LABEL	DESCRIPTION
PKI Storage Space in Use	This bar displays the percentage of the WiMAX Modem's PKI storage space that is currently in use. When the storage space is almost full, you should consider deleting expired or unnecessary certificates before adding more certificates.
#	The number of the item in this list.
Name	This field displays the name used to identify this certificate.
Subject	This field displays identifying information about the certificate's owner, such as CN (Common Name), OU (Organizational Unit or department), O (Organization or company) and C (Country). It is recommended that each certificate have unique subject information.

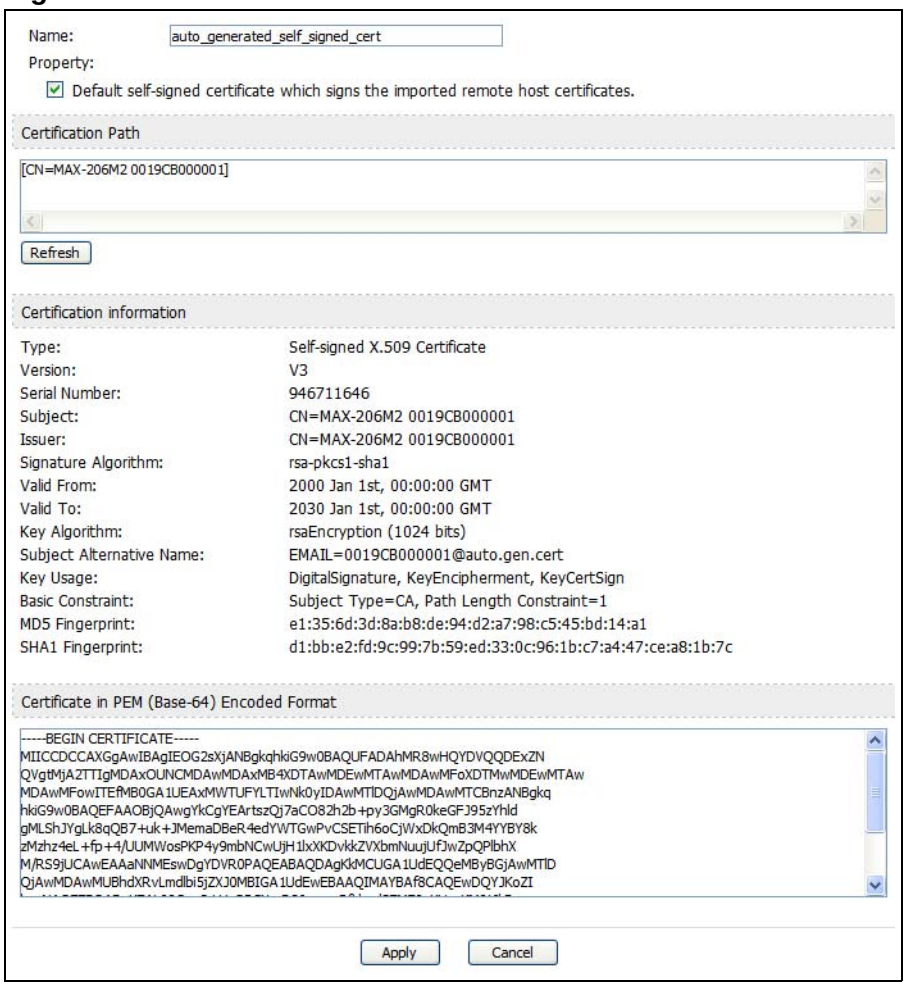
Table 63 TOOLS > Certificates > Trusted CAs (continued)

LABEL	DESCRIPTION
Issuer	This field displays identifying information about the certificate's issuing certification authority, such as a common name, organizational unit or department, organization or company and country. With self-signed certificates, this is the same information as in the **Subject** field.
Valid From	This field displays the date that the certificate becomes applicable. The text displays in red and includes a Not Yet Valid! message if the certificate has not yet become applicable.
Valid To	This field displays the date that the certificate expires. The text displays in red and includes an Expiring! or Expired! message if the certificate is about to expire or has already expired.
CRL Issuer	This field displays **Yes** if the certification authority issues CRL (Certificate Revocation Lists) for the certificates that it has issued and you have selected the **Check incoming certificates issued by this CA against a CRL** check box in the certificate's details screen to have the WiMAX Modem check the CRL before trusting any certificates issued by the certification authority. Otherwise the field displays **No**.
Action	Click the **Edit** icon to open a screen with an in-depth list of information about the certificate. Use the **Export** icon to save the certificate to a computer. Click the icon and then **Save** in the **File Download** screen. The **Save As** screen opens, browse to the location that you want to use and click **Save**. Click the **Delete** icon to remove the certificate. A window displays asking you to confirm that you want to delete the certificate. Note that subsequent certificates move up by one when you take this action.
Import	Click **Import** to open a screen where you can save the certificate of a certification authority that you trust, from your computer to the WiMAX Modem.
Refresh	Click this button to display the current validity status of the certificates.

15.3.1 Trusted CA Edit

Click **TOOLS > Certificates > Trusted CAs** and then click the **Edit** icon to open the **Trusted CAs** screen. Use this screen to view in-depth certificate information and change the certificate's name.

Figure 75 TOOLS > Certificates > Trusted CAs > Edit



The following table describes the labels in this screen.

Table 64 TOOLS > Certificates > Trusted CAs > Edit

LABEL	DESCRIPTION
Name	This field displays the identifying name of this certificate. You can use up to 31 alphanumeric and ;'~!@#$%^&()_+[]{}',.=- characters.
Property	Select **Default self-signed certificate which signs the imported remote host certificates** to use this certificate to sign the remote host certificates you upload in the **TOOLS > Certificates > Trusted CAs** screen.

Table 64 TOOLS > Certificates > Trusted CAs > Edit (continued)

LABEL	DESCRIPTION
Certification Path	This field displays for a certificate, not a certification request. Click the **Refresh** button to have this read-only text box display the hierarchy of certification authorities that validate the certificate (and the certificate itself). If the issuing certification authority is one that you have imported as a trusted certification authority, it may be the only certification authority in the list (along with the certificate itself). If the certificate is a self-signed certificate, the certificate itself is the only one in the list. The WiMAX Modem does not trust the certificate and displays "Not trusted" in this field if any certificate on the path has expired or been revoked.
Refresh	Click **Refresh** to display the certification path.
Certification Information	
Type	This field displays general information about the certificate. CA-signed means that a Certification Authority signed the certificate. Self-signed means that the certificate's owner signed the certificate (not a certification authority). "X.509" means that this certificate was created and signed according to the ITU-T X.509 recommendation that defines the formats for public-key certificates.
Version	This field displays the X.509 version number. "
Serial Number	This field displays the certificate's identification number given by the certification authority or generated by the WiMAX Modem.
Subject	This field displays information that identifies the owner of the certificate, such as Common Name (CN), Organizational Unit (OU), Organization (O) and Country (C).
Issuer	This field displays identifying information about the certificate's issuing certification authority, such as Common Name, Organizational Unit, Organization and Country. With self-signed certificates, this is the same as the **Subject Name** field. "none" displays for a certification request.
Signature Algorithm	This field displays the type of algorithm that was used to sign the certificate. The WiMAX Modem uses rsa-pkcs1-sha1 (RSA public-private key encryption algorithm and the SHA1 hash algorithm). Some certification authorities may use rsa-pkcs1-md5 (RSA public-private key encryption algorithm and the MD5 hash algorithm).
Valid From	This field displays the date that the certificate becomes applicable. "none" displays for a certification request.
Valid To	This field displays the date that the certificate expires. The text displays in red and includes an Expired! message if the certificate has expired. "none" displays for a certification request.
Key Algorithm	This field displays the type of algorithm that was used to generate the certificate's key pair (the WiMAX Modem uses RSA encryption) and the length of the key set in bits (1024 bits for example).
Subject Alternative Name	This field displays the certificate owner's IP address (IP), domain name (DNS) or e-mail address (EMAIL).

Table 64 TOOLS > Certificates > Trusted CAs > Edit (continued)

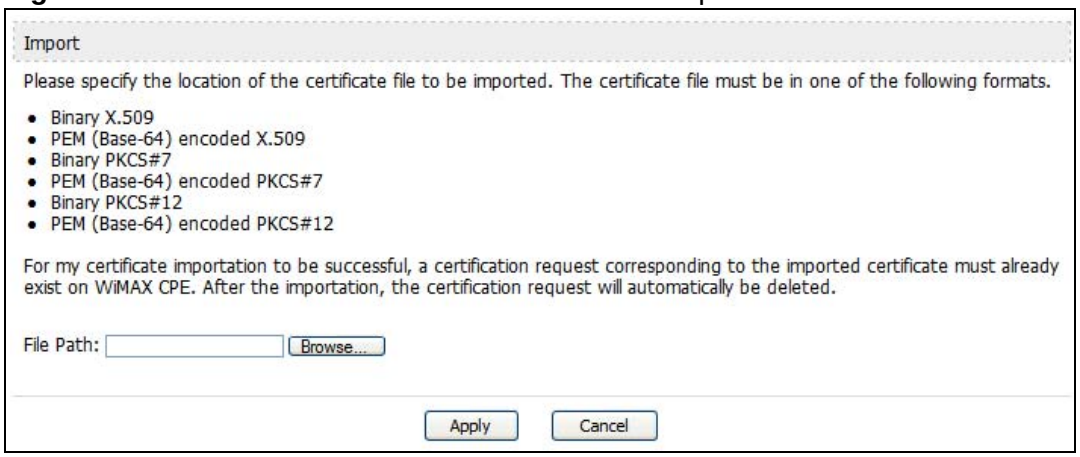
LABEL	DESCRIPTION
Key Usage	This field displays for what functions the certificate's key can be used. For example, "DigitalSignature" means that the key can be used to sign certificates and "KeyEncipherment" means that the key can be used to encrypt text.
Basic Constraint	This field displays general information about the certificate. For example, Subject Type=CA means that this is a certification authority's certificate and "Path Length Constraint=1" means that there can only be one certification authority in the certificate's path. This field does not display for a certification request.
MD5 Fingerprint	This is the certificate's message digest that the WiMAX Modem calculated using the MD5 algorithm.
SHA1 Fingerprint	This is the certificate's message digest that the WiMAX Modem calculated using the SHA1 algorithm.
Certificate in PEM (Base-64) Encoded Format	This read-only text box displays the certificate or certification request in Privacy Enhanced Mail (PEM) format. PEM uses lowercase letters, uppercase letters and numerals to convert the binary certificate into a printable form. You can copy and paste a certification request into a certification authority's web page, an e-mail that you send to the certification authority or a text editor and save the file on a management computer for later manual enrollment. You can copy and paste a certificate into an e-mail to send to friends or colleagues or you can copy and paste a certificate into a text editor and save the file on a management computer for later distribution (via floppy disk for example).
Apply	Click to save your changes.
Cancel	Click to return to the previous screen without saving your changes.

15.3.2 Trusted CA Import

Click **TOOLS > Certificates > Trusted CAs** and then click **Import** to open the **Trusted CA Import** screen. Follow the instructions in this screen to save a trusted certification authority's certificate from a computer to the WiMAX Modem. The WiMAX Modem trusts any valid certificate signed by any of the imported trusted CA certificates.

Note: You must remove any spaces from the certificate's filename before you can import the certificate.

Figure 76 TOOLS > Certificates > Trusted CAs > Import


Import
Please specify the location of the certificate file to be imported. The certificate file must be in one of the following formats.
Binary X.509
PEM (Base-64) encoded X.509
Binary PKCS#7
PEM (Base-64) encoded PKCS#7
Binary PKCS#12
PEM (Base-64) encoded PKCS#12
For my certificate importation to be successful, a certification request corresponding to the imported certificate must already exist on WiMAX CPE. After the importation, the certification request will automatically be deleted.
File Path:
Browse...
Apply
Cancel

The following table describes the labels in this screen.

Table 65 TOOLS > Certificates > Trusted CAs Import

LABEL	DESCRIPTION
File Path	Type in the location of the file you want to upload in this field or click **Browse** to find it.
Choose...	Click to find the certificate file you want to upload.
Apply	Click to save your changes.
Cancel	Click to return to the previous screen without saving your changes.

15.4 Technical Reference

The following section contains additional technical information about the WiMAX Modem features described in this chapter.

15.4.1 Certificate Authorities

When using public-key cryptology for authentication, each host has two keys. One key is public and can be made openly available. The other key is private and must be kept secure.

These keys work like a handwritten signature (in fact, certificates are often referred to as “digital signatures”). Only you can write your signature exactly as it ought to look. When people know what your signature ought to look like, they can verify whether something was signed by you, or by someone else. In the same way, your private key “writes” your digital signature and your public key allows people to verify whether data was signed by you, or by someone else. This process works as follows.

1. Tim wants to send a message to Jenny. He needs her to be sure that it comes from him, and that the message content has not been altered by anyone else along the way. Tim generates a public key pair (one public key and one private key).
2. Tim keeps the private key and makes the public key openly available. This means that anyone who receives a message seeming to come from Tim can read it and verify whether it is really from him or not.
3. Tim uses his private key to sign the message and sends it to Jenny.
4. Jenny receives the message and uses Tim’s public key to verify it. Jenny knows that the message is from Tim, and she knows that although other people may have been able to read the message, no-one can have altered it (because they cannot re-sign the message with Tim’s private key).
5. Additionally, Jenny uses her own private key to sign a message and Tim uses Jenny’s public key to verify the message.

The WiMAX Modem uses certificates based on public-key cryptology to authenticate users attempting to establish a connection, not to encrypt the data that you send after establishing a connection. The method used to secure the data that you send through an established connection depends on the type of connection. For example, a VPN tunnel might use the triple DES encryption algorithm.

The certification authority uses its private key to sign certificates. Anyone can then use the certification authority’s public key to verify the certificates.

A certification path is the hierarchy of certification authority certificates that validate a certificate. The WiMAX Modem does not trust a certificate if any certificate on its path has expired or been revoked.

Certification authorities maintain directory servers with databases of valid and revoked certificates. A directory of certificates that have been revoked before the scheduled expiration is called a CRL (Certificate Revocation List). The WiMAX Modem can check a peer's certificate against a directory server's list of revoked certificates. The framework of servers, software, procedures and policies that handles keys is called PKI (public-key infrastructure).

15.4.1.1 Advantages of Certificates

Certificates offer the following benefits.

- The WiMAX Modem only has to store the certificates of the certification authorities that you decide to trust, no matter how many devices you need to authenticate.
- Key distribution is simple and very secure since you can freely distribute public keys and you never need to transmit private keys.

15.4.1.2 Self-signed Certificates

You can have the WiMAX Modem act as a certification authority and sign its own certificates.

15.4.1.3 Factory Default Certificate

The WiMAX Modem generates its own unique self-signed certificate when you first turn it on. This certificate is referred to in the GUI as the factory default certificate.

15.4.1.4 Certificate File Formats

Any certificate that you want to import has to be in one of these file formats:

- Binary X.509: This is an ITU-T recommendation that defines the formats for X.509 certificates.
- PEM (Base-64) encoded X.509: This Privacy Enhanced Mail format uses lowercase letters, uppercase letters and numerals to convert a binary X.509 certificate into a printable form.
- Binary PKCS#7: This is a standard that defines the general syntax for data (including digital signatures) that may be encrypted. A PKCS #7 file is used to transfer a public key certificate. The private key is not included. The WiMAX Modem currently allows the importation of a PKS#7 file that contains a single certificate.
- PEM (Base-64) encoded PKCS#7: This Privacy Enhanced Mail (PEM) format uses lowercase letters, uppercase letters and numerals to convert a binary PKCS#7 certificate into a printable form.

Note: Be careful to not convert a binary file to text during the transfer process. It is easy for this to occur since many programs use text files by default.

15.4.2 Verifying a Certificate

Before you import a certificate into the WiMAX Modem, you should verify that you have the correct certificate. This is especially true of trusted certificates since the WiMAX Modem also trusts any valid certificate signed by any of the imported trusted certificates.

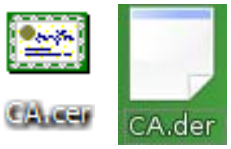
15.4.2.1 Checking the Fingerprint of a Certificate on Your Computer

A certificate's fingerprints are message digests calculated using the MD5 or SHA1 algorithms. The following procedure describes how to check a certificate's fingerprint to verify that you have the actual certificate.

1 Browse to where you have the certificate saved on your computer.

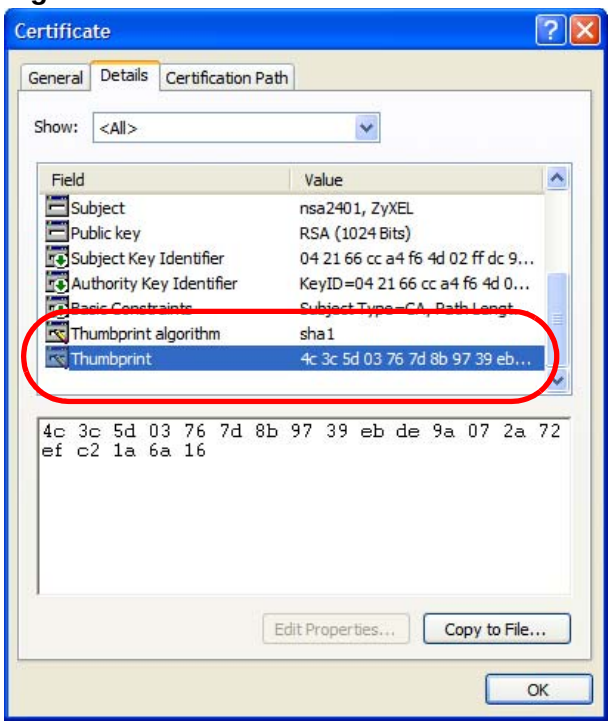
2 Make sure that the certificate has a ".cer" or ".crt" file name extension. (On some Linux distributions, the file extension may be ".der".)

Figure 77 Remote Host Certificates



3 Double-click the certificate's icon to open the **Certificate** window. Click the **Details** tab and scroll down to the **Thumbprint Algorithm** and **Thumbprint** fields.

Figure 78 Certificate Details



4 Use a secure method to verify that the certificate owner has the same information in the **Thumbprint Algorithm** and **Thumbprint** fields. The secure method may very based on your situation. Possible examples would be over the telephone or through an HTTPS connection.

16

The Firewall Screens

16.1 Overview

Use the **TOOLS > Firewall** screens to manage WiMAX Modem's firewall security measures.

Originally, the term *firewall* referred to a construction technique designed to prevent the spread of fire from one room to another. The networking term "firewall" is a system or group of systems that enforces an access-control policy between two networks. It may also be defined as a mechanism used to protect a trusted network from an untrusted network. Of course, firewalls cannot solve every security problem.

A firewall is one of the mechanisms used to establish a network security perimeter in support of a network security policy. It should never be the only mechanism or method employed. For a firewall to guard effectively, you must design and deploy it appropriately. This requires integrating the firewall into a broad information-security policy. In addition, specific policies must be implemented within the firewall itself.

16.1.1 What You Can Do in This Chapter

- The **Firewall Setting** screen (Section 16.2 on page 190) lets you configure the basic settings for your firewall.
- The **Service Setting** screen (Section 16.3 on page 193) lets you enable service blocking, set up the date and time service blocking is effective, and to maintain the list of services you want to block.

16.1.2 What You Need to Know

The following terms and concepts may help as you read through this chapter.

About the WiMAX Modem Firewall

The WiMAX Modem firewall is a stateful inspection firewall and is designed to protect against Denial of Service attacks when activated. The WiMAX Modem's purpose is to allow a private Local Area Network (LAN) to be securely connected to

the Internet. The WiMAX Modem can be used to prevent theft, destruction and modification of data, as well as log events, which may be important to the security of your network.

The WiMAX Modem is installed between the LAN and a WiMAX base station connecting to the Internet. This allows it to act as a secure gateway for all data passing between the Internet and the LAN.

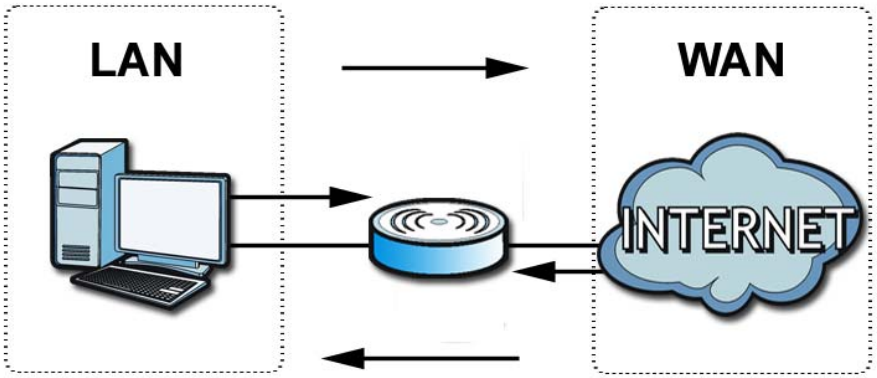
The WiMAX Modem has one Ethernet (LAN) port. The LAN (Local Area Network) port attaches to a network of computers, which needs security from the outside world. These computers will have access to Internet services such as e-mail, FTP and the World Wide Web. However, “inbound access” is not allowed (by default) unless the remote host is authorized to use a specific service.

16.2 Firewall Setting

This section describes firewalls and the built-in WiMAX Modem’s firewall features.

16.2.1 Firewall Rule Directions

Figure 79 Firewall Rule Directions



LAN-to-WAN rules are local network to Internet firewall rules. The default is to forward all traffic from your local network to the Internet.

You can block certain **LAN-to-WAN** traffic in the **Services** screen (click the **Services** tab). All services displayed in the **Blocked Services** list box are **LAN-to-WAN** firewall rules that block those services originating from the LAN.

Blocked **LAN-to-WAN** packets are considered alerts. Alerts are “higher priority logs” that include system errors, attacks and attempted access to blocked web sites. Alerts appear in red in the **View Log** screen. You may choose to have alerts e-mailed immediately in the **Log Settings** screen.

LAN-to-LAN/WiMAX Modem means the LAN to the WiMAX Modem LAN interface. This is always allowed, as this is how you manage the WiMAX Modem from your local computer.

WAN-to-LAN rules are Internet to your local network firewall rules. The default is to block all traffic from the Internet to your local network.

How can you forward certain WAN to LAN traffic? You may allow traffic originating from the WAN to be forwarded to the LAN by:

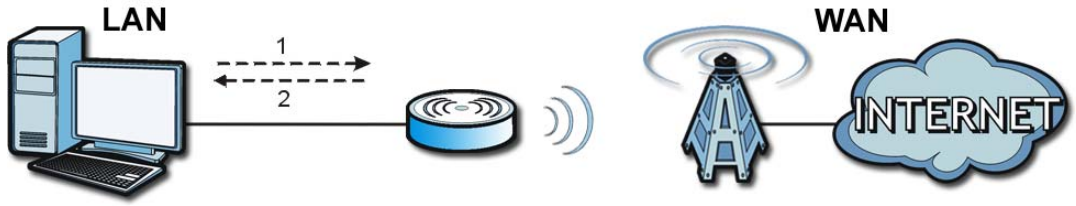
- Configuring NAT port forwarding rules.
- Configuring **WAN** or **LAN & WAN** access for services in the **Remote MGMT** screens or SMT menus. When you allow remote management from the WAN, you are actually configuring WAN-to-WAN/WiMAX Modem firewall rules. WAN-to-WAN/WiMAX Modem firewall rules are Internet to the WiMAX Modem WAN interface firewall rules. The default is to block all such traffic. When you decide what WAN-to-LAN packets to log, you are in fact deciding what **WAN-to-LAN** and WAN-to-WAN/WiMAX Modem packets to log.

Forwarded **WAN-to-LAN** packets are not considered alerts.

16.2.2 Triangle Route

When the firewall is on, your WiMAX Modem acts as a secure gateway between your LAN and the Internet. In an ideal network topology, all incoming and outgoing network traffic passes through the WiMAX Modem to protect your LAN against attacks.

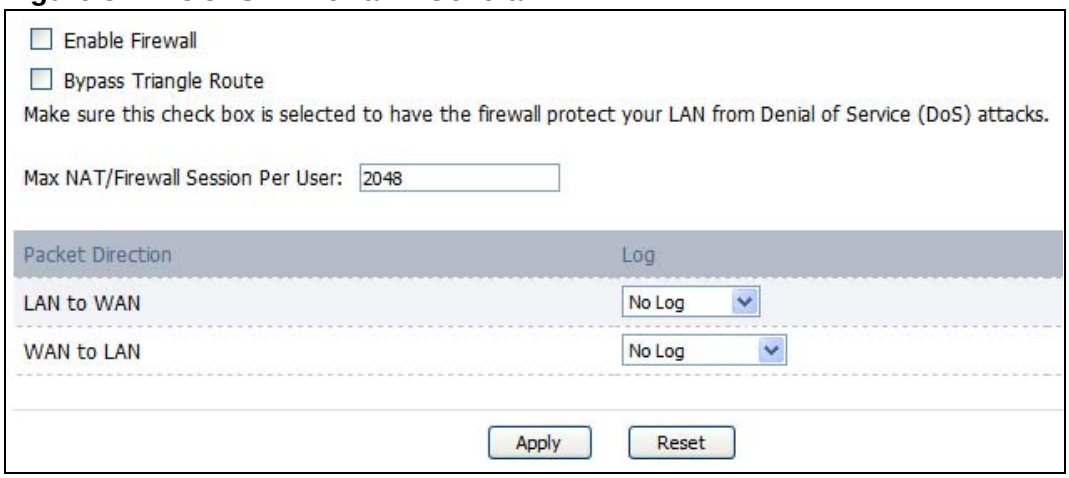
Figure 80 Ideal Firewall Setup



16.2.3 General Options

Click **TOOLS > Firewall > General** to configure the basic settings for your firewall.

Figure 81 TOOLS > Firewall > General



The following table describes the labels in this screen.

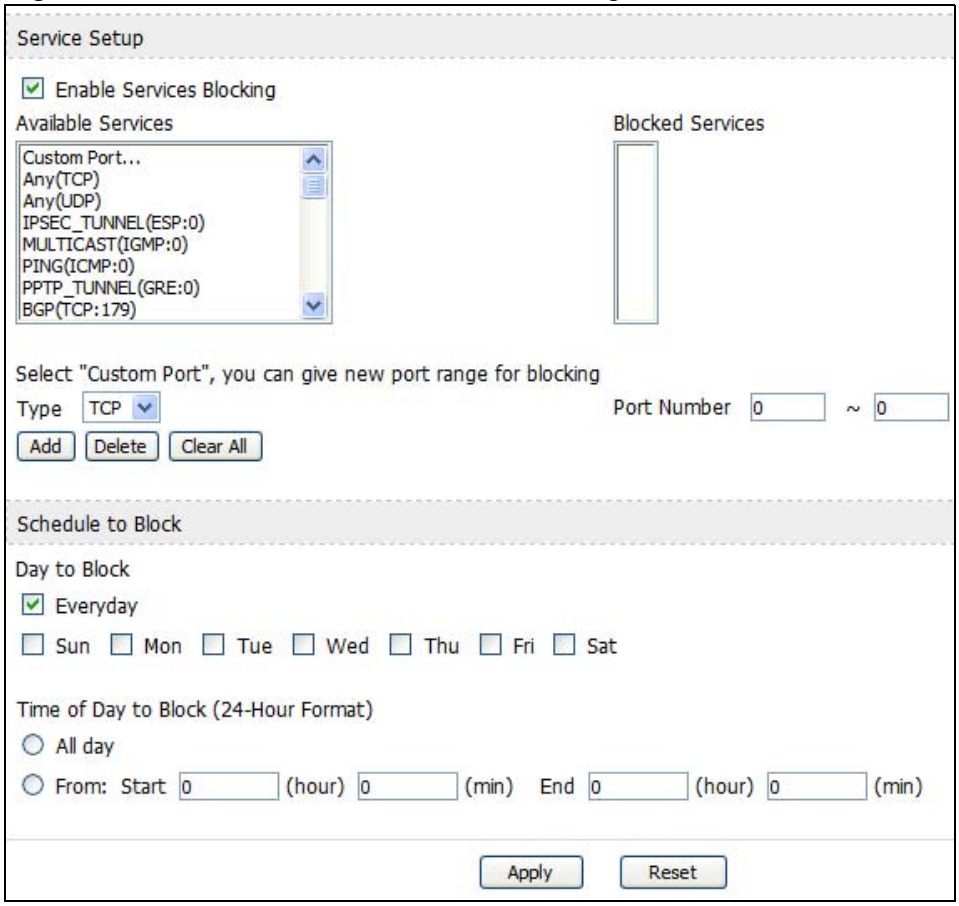
Table 66 TOOLS > Firewall > General

LABEL	DESCRIPTION
Enable Firewall	Select this to activate the firewall. The WiMAX Modem controls access and protects against Denial of Service (DoS) attacks when the firewall is activated.
Bypass Triangle Route	Select this if you want to let some traffic from the WAN go directly to a computer in the LAN without passing through the WiMAX Modem.
Max NAT/ Firewall Session Per User	Select the maximum number of NAT rules and firewall rules the WiMAX Modem enforces at one time. The WiMAX Modem automatically allocates memory for the maximum number of rules, regardless of whether or not there is a rule to enforce. This is the same number you enter in **ADVANCED > NAT Configuration > General**.
Packet Direction	
Log	Select the situations in which you want to create log entries for firewall events. **No Log** - do not create any log entries **Log Blocked** - (**LAN to WAN** only) create log entries when packets are blocked **Log Forwarded -** (**WAN to LAN** only) create log entries when packets are forwarded **Log All** - create log entries for every packet
Apply	Click to save your changes.
Reset	Click to restore your previously saved settings.

16.3 Services

Click **TOOLS > Firewall > Services** to enable service blocking, set up the date and time service blocking is effective, and to maintain the list of services you want to block.

Figure 82 TOOLS > Firewall > Service Setting



The following table describes the labels in this screen.

Table 67 TOOLS > Firewall > Service Setting

LABEL	DESCRIPTION
Service Setup	
Enable Services Blocking	Select this to activate service blocking. The **Schedule to** Block section controls what days and what times service blocking is actually effective, however.
Available Services	This is a list of pre-defined services (destination ports) you may prohibit your LAN computers from using. Select the port you want to block, and click **Add** to add the port to the **Blocked Services** field. A custom port is a service that is not available in the pre-defined **Available Services** list. You must define it using the **Type** and **Port Number** fields.

Table 67 TOOLS > Firewall > Service Setting (continued)

LABEL	DESCRIPTION
Blocked Services	This is a list of services (ports) that are inaccessible to computers on your LAN when service blocking is effective. To remove a service from this list, select the service, and click **Delete**.
Type	Select **TCP** or **UDP**, based on which one the custom port uses.
Port Number	Enter the range of port numbers that defines the service. For example, suppose you want to define the Gnutella service. Select **TCP** type and enter a port range of **6345-6349**.
Add	Click this to add the selected service in **Available Services** to the **Blocked Services** list.
Delete	Select a service in the **Blocked Services**, and click this to remove the service from the list.
Clear All	Click this to remove all the services in the **Blocked Services** list.
Schedule to Block	
Day to Block	Select which days of the week you want the service blocking to be effective.
Time of Day to Block	Select what time each day you want service blocking to be effective. Enter times in 24-hour format; for example, 3:00pm should be entered as 15:00.
Apply	Click to save your changes.
Reset	Click to restore your previously saved settings.

16.4 Technical Reference

The following section contains additional technical information about the WiMAX Modem features described in this chapter.

16.4.1 Stateful Inspection Firewall.

Stateful inspection firewalls restrict access by screening data packets against defined access rules. They make access control decisions based on IP address and protocol. They also "inspect" the session data to assure the integrity of the connection and to adapt to dynamic protocols. These firewalls generally provide the best speed and transparency; however, they may lack the granular application level access control or caching that some proxies support. Firewalls, of one type or another, have become an integral part of standard security solutions for enterprises.

16.4.2 Guidelines For Enhancing Security With Your Firewall

1. Change the default password via web configurator.
2. Think about access control before you connect to the network in any way.
3. Limit who can access your router.
4. Don't enable any local service (such as telnet or FTP) that you don't use. Any enabled service could present a potential security risk. A determined hacker might be able to find creative ways to misuse the enabled services to access the firewall or the network.
5. For local services that are enabled, protect against misuse. Protect by configuring the services to communicate only with specific peers, and protect by configuring rules to block packets for the services at specific interfaces.
6. Protect against IP spoofing by making sure the firewall is active.
7. Keep the firewall in a secured (locked) room.

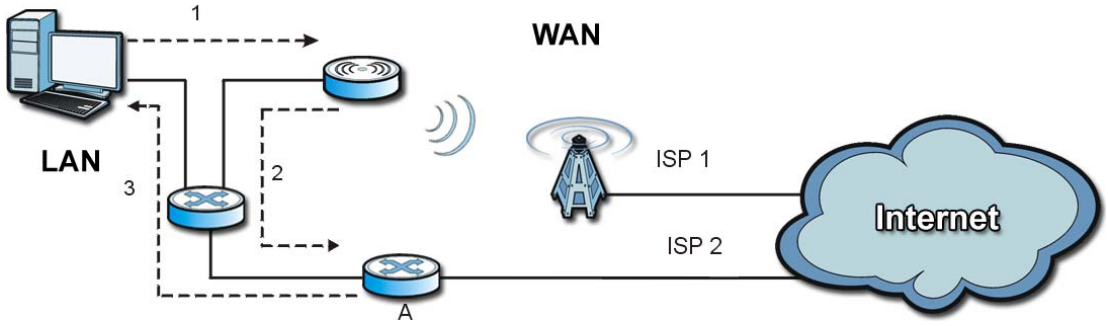
16.4.3 The “Triangle Route” Problem

A traffic route is a path for sending or receiving data packets between two Ethernet devices. You may have more than one connection to the Internet (through one or more ISPs). If an alternate gateway is on the LAN (and its IP address is in the same subnet as the WiMAX Modem’s LAN IP address), the “triangle route” (also called asymmetrical route) problem may occur. The steps below describe the “triangle route” problem.

1. A computer on the LAN initiates a connection by sending out a SYN packet to a receiving server on the WAN.
2. The WiMAX Modem reroutes the SYN packet through Gateway **A** on the LAN to the WAN.
3. The reply from the WAN goes directly to the computer on the LAN without going through the WiMAX Modem.

As a result, the WiMAX Modem resets the connection, as the connection has not been acknowledged.

Figure 83 "Triangle Route" Problem



16.4.3.1 Solving the "Triangle Route" Problem

If you have the WiMAX Modem allow triangle route sessions, traffic from the WAN can go directly to a LAN computer without passing through the WiMAX Modem and its firewall protection.

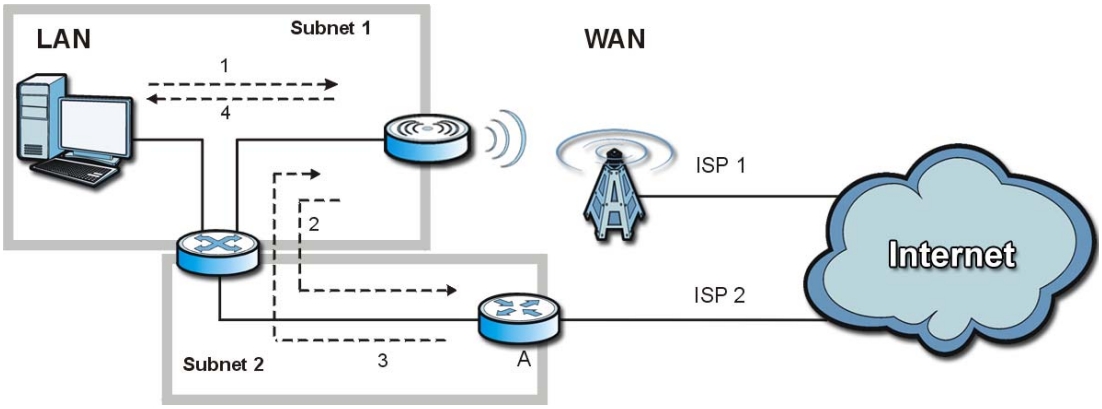
Another solution is to use IP alias. IP alias allows you to partition your network into logical sections over the same Ethernet interface. Your WiMAX Modem supports up to three logical LAN interfaces with the WiMAX Modem being the gateway for each logical network.

It's like having multiple LAN networks that actually use the same physical cables and ports. By putting your LAN and Gateway **A** in different subnets, all returning network traffic must pass through the WiMAX Modem to your LAN. The following steps describe such a scenario.

1. A computer on the LAN initiates a connection by sending a SYN packet to a receiving server on the WAN.
2. The WiMAX Modem reroutes the packet to Gateway A, which is in Subnet 2.
3. The reply from the WAN goes to the WiMAX Modem.

4 The WiMAX Modem then sends it to the computer on the LAN in Subnet 1.

Figure 84 IP Alias



17

Content Filter

17.1 Overview

Use the **TOOLS > Content Filter** screens to create and enforce policies that restrict access to the Internet based on content

Internet content filtering allows you to create and enforce Internet access policies tailored to their needs. Content filtering is the ability to block certain web features or specific URL keywords. The WiMAX Modem can block web features such as ActiveX controls, Java applets, cookies and disable web proxies. The WiMAX Modem also allows you to define time periods and days during which the WiMAX Modem performs content filtering.

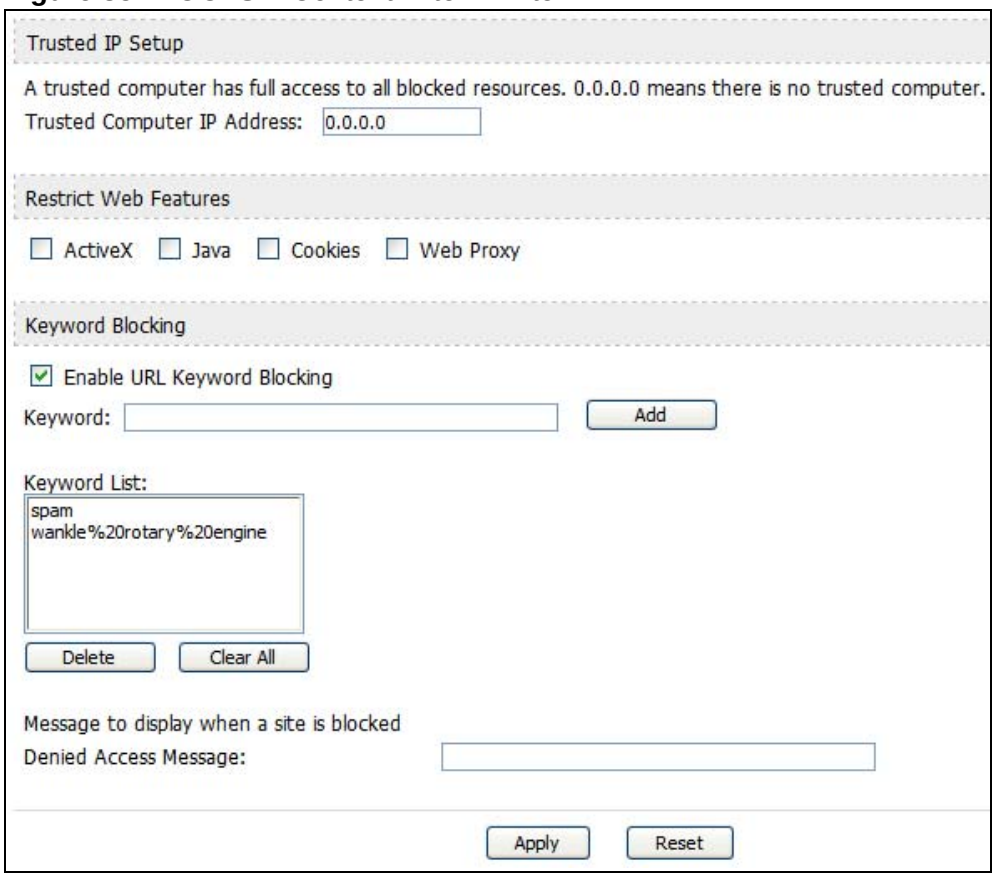
17.1.1 What You Can Do in This Chapter

- The **Filter** screen (Section 17.2 on page 200) lets you set up a trusted IP address, which web features are restricted, and which keywords are blocked when content filtering is effective.
- The **Schedule** screen (Section 17.3 on page 202) lets you schedule content filtering.

17.2 Filter

Click **TOOLS > Content Filter > Filter** to set up a trusted IP address, which web features are restricted, and which keywords are blocked when content filtering is effective.

Figure 85 TOOLS > Content Filter > Filter



The following table describes the labels in this screen.

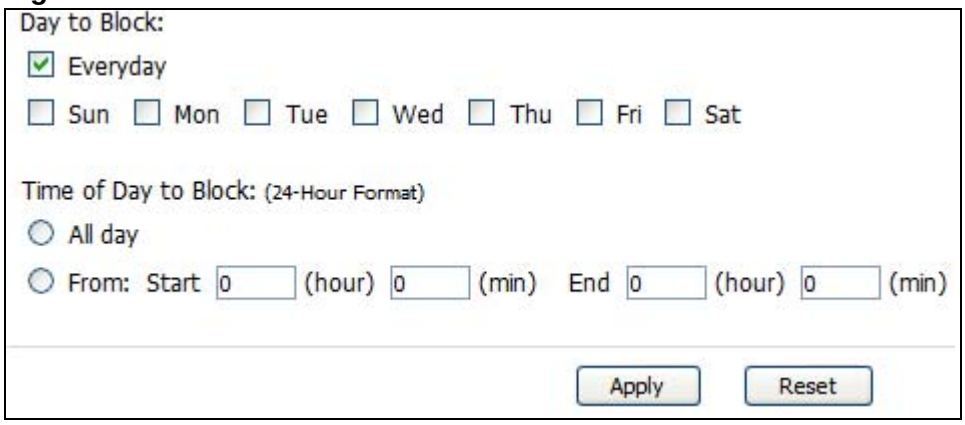
Table 68 TOOLS > Content Filter > Filter

LABEL	DESCRIPTION
Trusted IP Setup	
Trusted Computer IP Address	You can allow a specific computer to access all Internet resources without the restrictions you set in these screens. Enter the IP address of the trusted computer.
Restrict Web Features	Select the web features you want to disable. If a user downloads a page with a restricted feature, that part of the web page appears blank or grayed out. **ActiveX** - This is a tool for building dynamic and active Web pages and distributed object applications. When you visit an ActiveX Web site, ActiveX controls are downloaded to your browser, where they remain in case you visit the site again. **Java** - This is used to build downloadable Web components or Internet and intranet business applications of all kinds. **Cookies** - This is used by Web servers to track usage and to provide service based on ID. **Web Proxy** - This is a server that acts as an intermediary between a user and the Internet to provide security, administrative control, and caching service. When a proxy server is located on the WAN, it is possible for LAN users to avoid content filtering restrictions.
Keyword Blocking	
Enable URL Keyword Blocking	Select this if you want the WiMAX Modem to block Web sites based on words in the web site address. For example, if you block the keyword **bad**, http://www.website.com/bad.html is blocked.
Keyword	Type a keyword you want to block in this field. You can use up to 128 printable ASCII characters. There is no wildcard character, however.
Add	Click this to add the specified **Keyword** to the **Keyword List**. You can enter up to 128 keywords.
Keyword List	This field displays the keywords that are blocked when **Enable URL Keyword Blocking** is selected. To delete a keyword, select it, click **Delete**, and click **Apply**.
Delete	Click **Delete** to remove the selected keyword in the **Keyword List**. The keyword disappears after you click **Apply**.
Clear All	Click this button to remove all of the keywords in the **Keyword List**.
Denied Access Message	Enter the message that is displayed when the WiMAX Modem's content filter feature blocks access to a web site.
Apply	Click to save your changes.
Reset	Click to restore your previously saved settings.

17.3 Schedule

Click **TOOLS > Content Filter > Schedule** to schedule content filtering.

Figure 86 TOOLS > Content Filter > Schedule



The following table describes the labels in this screen.

Table 69 TOOLS > Content Filter > Schedule

LABEL	DESCRIPTION
Day to Block	Select which days of the week you want content filtering to be effective.
Time of Day to Block	Select what time each day you want content filtering to be effective. Enter times in 24-hour format; for example, 3:00pm should be entered as 15:00.
Apply	Click to save your changes.
Reset	Click to restore your previously saved settings.

18

The Remote Management Screens

18.1 Overview

Use the **TOOLS > Remote Management** screens to control which computers can use which services to access the WiMAX Modem on each interface.

Remote management allows you to determine which services/protocols can access which WiMAX Modem interface (if any) from which computers.

You may manage your WiMAX Modem from a remote location via:

Table 70 Remote Management

- Internet (WAN only)
- LAN only
- ALL (LAN and WAN)
- Neither (Disable).

To disable remote management of a service, select **Disable** in the corresponding **Server Access** field.

You may only have one remote management session running at a time. The WiMAX Modem automatically disconnects a remote management session of lower priority when another remote management session of higher priority starts. The priorities for the different types of remote management sessions are as follows.

1 Telnet

2 HTTP

18.1.1 What You Can Do in This Chapter

- The **WWW** screen (Section 18.2 on page 205) lets you control HTTP access to your WiMAX Modem.
- The **Telnet** screen (Section 18.3 on page 206) lets you control Telnet access to your WiMAX Modem.
- The **FTP** screen (Section 18.4 on page 206) lets you control FTP access to your WiMAX Modem.

- The **SNMP** screen (Section 18.5 on page 207) lets you control SNMP access to your WiMAX Modem.
- The **DNS** screen (Section 18.6 on page 210) lets you control DNS access to your WiMAX Modem.
- The **Security** screen (Section 18.7 on page 211) lets you control how your WiMAX Modem responds to other types of requests.
- The **TR069** screen (Section 18.8 on page 212) lets you configure the WiMAX Modem's auto-configuration and dynamic service configuration options.

18.1.2 What You Need to Know

The following terms and concepts may help as you read through this chapter.

Remote Management Limitations

Remote management over LAN or WAN will not work when:

1. A filter in SMT menu 3.1 (LAN) or in menu 11.5 (WAN) is applied to block a Telnet, FTP or Web service.
2. You have disabled that service in one of the remote management screens.
3. The IP address in the **Secured Client IP** field does not match the client IP address. If it does not match, the WiMAX Modem will disconnect the session immediately.
4. There is already another remote management session with an equal or higher priority running. You may only have one remote management session running at one time.

Remote Management and NAT

When NAT is enabled:

- Use the WiMAX Modem's WAN IP address when configuring from the WAN.
- Use the WiMAX Modem's LAN IP address when configuring from the LAN.

System Timeout

There is a default system management idle timeout of five minutes (three hundred seconds). The WiMAX Modem automatically logs you out if the management session remains idle for longer than this timeout period. The management session does not time out when a statistics screen is polling. You can change the timeout period in the **Maintenance > System > General** screen.

SNMP

Simple Network Management Protocol (SNMP) is a protocol used for exchanging management information between network devices. SNMP is a member of the TCP/IP protocol suite. Your WiMAX Modem supports SNMP agent functionality, which allows a manager station to manage and monitor the WiMAX Modem through the network. The WiMAX Modem supports SNMP version one (SNMPv1) and version two (SNMPv2). The next figure illustrates an SNMP management operation.

Note: SNMP is only available if TCP/IP is configured.

18.2 WWW

Click **TOOLS > Remote Management > WWW** to control HTTP access to your WiMAX Modem.

Figure 87 TOOLS > Remote Management > WWW

The following table describes the labels in this screen.

Table 71 TOOLS > Remote Management > WWW

LABEL	DESCRIPTION
Server Port	Enter the port number this service can use to access the WiMAX Modem. The computer must use the same port number.
Server Access	Select the interface(s) through which a computer may access the WiMAX Modem using this service.
Secured Client IP Address	Select **All** to allow any computer to access the WiMAX Modem using this service. Select **Selected** to only allow the computer with the IP address that you specify to access the WiMAX Modem using this service.
Apply	Click to save your changes.
Reset	Click to restore your previously saved settings.

18.3 Telnet

Click **TOOLS > Remote Management > Telnet** to control Telnet access to your WiMAX Modem.

Figure 88 TOOLS > Remote Management > Telnet

The following table describes the labels in this screen.

Table 72 TOOLS > Remote Management > Telnet

LABEL	DESCRIPTION
Server Port	Enter the port number this service can use to access the WiMAX Modem. The computer must use the same port number.
Server Access	Select the interface(s) through which a computer may access the WiMAX Modem using this service.
Secured Client IP Address	Select **All** to allow any computer to access the WiMAX Modem using this service. Select **Selected** to only allow the computer with the IP address that you specify to access the WiMAX Modem using this service.
Apply	Click to save your changes.
Reset	Click to restore your previously saved settings.

18.4 FTP

Click **TOOLS > Remote Management > FTP** to control FTP access to your WiMAX Modem.

Figure 89 TOOLS > Remote Management > FTP

The following table describes the labels in this screen.

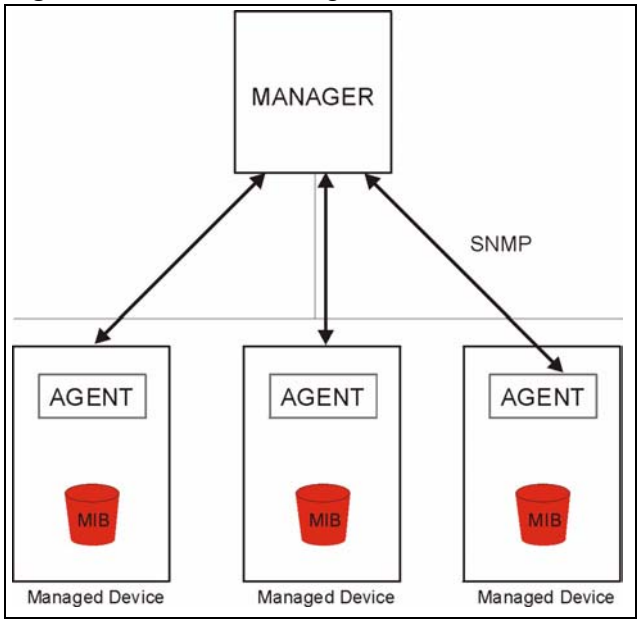
Table 73 TOOLS > Remote Management > FTP

LABEL	DESCRIPTION
Server Port	Enter the port number this service can use to access the WiMAX Modem. The computer must use the same port number.
Server Access	Select the interface(s) through which a computer may access the WiMAX Modem using this service.
Secured Client IP Address	Select **All** to allow any computer to access the WiMAX Modem using this service. Select **Selected** to only allow the computer with the IP address that you specify to access the WiMAX Modem using this service.
Apply	Click to save your changes.
Reset	Click to restore your previously saved settings.

18.5 SNMP

An SNMP managed network consists of two main types of component: agents and a manager.

Figure 90 SNMP Management Model



An agent is a management software module that resides in a managed device (the WiMAX Modem). An agent translates the local management information from the managed device into a form compatible with SNMP. The manager is the console through which network administrators perform network management functions. It executes applications that control and monitor managed devices.

The managed devices contain object variables/managed objects that define each piece of information to be collected about a device. Examples of variables include such as number of packets received, node port status etc. A Management Information Base (MIB) is a collection of managed objects. SNMP allows a manager and agents to communicate for the purpose of accessing these objects. The WiMAX Modem supports MIB II that is defined in RFC-1213 and RFC-1215. The focus of the MIBs is to let administrators collect statistical data and monitor status and performance.

SNMP itself is a simple request/response protocol based on the manager/agent model. The manager issues a request and the agent returns responses using the following protocol operations:

- Get - Allows the manager to retrieve an object variable from the agent.
- GetNext - Allows the manager to retrieve the next object variable from a table or list within an agent. In SNMPv1, when a manager wants to retrieve all elements of a table from an agent, it initiates a Get operation, followed by a series of GetNext operations.
- Set - Allows the manager to set values for object variables within an agent.
- Trap - Used by the agent to inform the manager of some events.

18.5.1 SNMP Traps

The WiMAX Modem sends traps to the SNMP manager when any of the following events occurs:

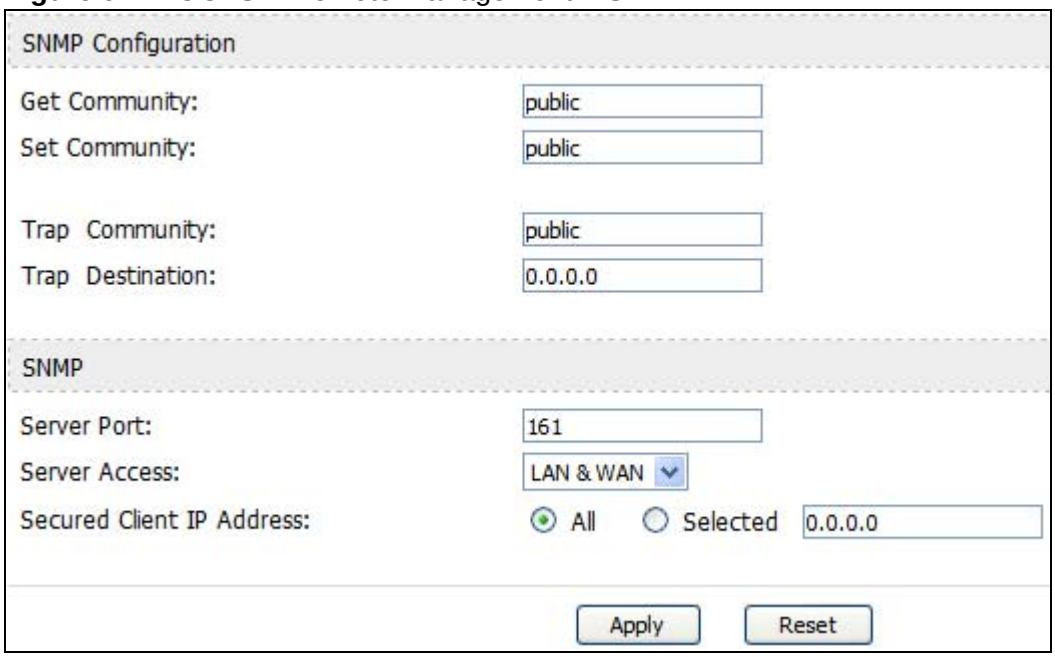
Table 74 SNMP Traps

TRAP #	TRAP NAME	DESCRIPTION
0	coldStart (defined in *RFC-1215*)	A trap is sent after booting (power on).
1	warmStart (defined in *RFC-1215*)	A trap is sent after booting (software reboot).
4	authenticationFailure (defined in *RFC-1215*)	A trap is sent to the manager when receiving any SNMP get or set requirements with the wrong community (password).
6	whyReboot (defined in ZYXEL-MIB)	A trap is sent with the reason of restart before rebooting when the system is going to restart (warm start).
6a	For intentional reboot:	A trap is sent with the message "System reboot by user!" if reboot is done intentionally, (for example, download new files, CI command "sys reboot", etc.).
6b	For fatal error:	A trap is sent with the message of the fatal code if the system reboots because of fatal errors.

18.5.2 SNMP Options

Click **TOOLS > Remote Management > SNMP** to access this screen. Use SNMP options to control SNMP access to your WiMAX Modem.

Figure 91 TOOLS > Remote Management > SNMP



The following table describes the labels in this screen.

Table 75 TOOLS > Remote Management > SNMP

LABEL	DESCRIPTION
SNMP Configuration	
Get Community	Enter the **Get Community**, which is the password for the incoming Get and GetNext requests from the management station. The default is public and allows all requests.
Set Community	Enter the **Set community**, which is the password for incoming Set requests from the management station. The default is public and allows all requests.
Trap Community	Enter the trap community, which is the password sent with each trap to the SNMP manager. The default is public and allows all requests.
Trap Destination	Enter the IP address of the station to send your SNMP traps to.
SNMP	
Port	You may change the server port number for a service if needed, however you must use the same port number in order to use that service for remote management.
Access Status	Select the interface(s) through which a computer may access the WiMAX Modem using this service.

Table 75 TOOLS > Remote Management > SNMP (continued)

LABEL	DESCRIPTION
Secured Client IP	A secured client is a “trusted” computer that is allowed to communicate with the WiMAX Modem using this service. Select **All** to allow any computer to access the WiMAX Modem using this service. Choose **Selected** to just allow the computer with the IP address that you specify to access the WiMAX Modem using this service.
Apply	Click to save your changes.
Reset	Click to restore your previously saved settings.

18.6 DNS

Click **TOOLS > Remote Management > DNS** to access this screen. Use this screen to control DNS access to your WiMAX Modem.

Figure 92 TOOLS > Remote Management > DNS

The following table describes the labels in this screen.

Table 76 TOOLS > Remote Management > DNS

LABEL	DESCRIPTION
Server Port	This field is read-only. This field displays the port number this service uses to access the WiMAX Modem. The computer must use the same port number.
Server Access	Select the interface(s) through which a computer may access the WiMAX Modem using this service.
Secured Client IP Address	Select **All** to allow any computer to access the WiMAX Modem using this service. Select **Selected** to only allow the computer with the IP address that you specify to access the WiMAX Modem using this service.
Apply	Click to save your changes.
Reset	Click to restore your previously saved settings.

18.7 Security

Click **TOOLS > Remote Management > Security** to access this screen. Use this screen to control how your WiMAX Modem responds to other types of requests.

Figure 93 TOOLS > Remote Management > Security

The following table describes the labels in this screen.

Table 77 TOOLS > Remote Management > Security

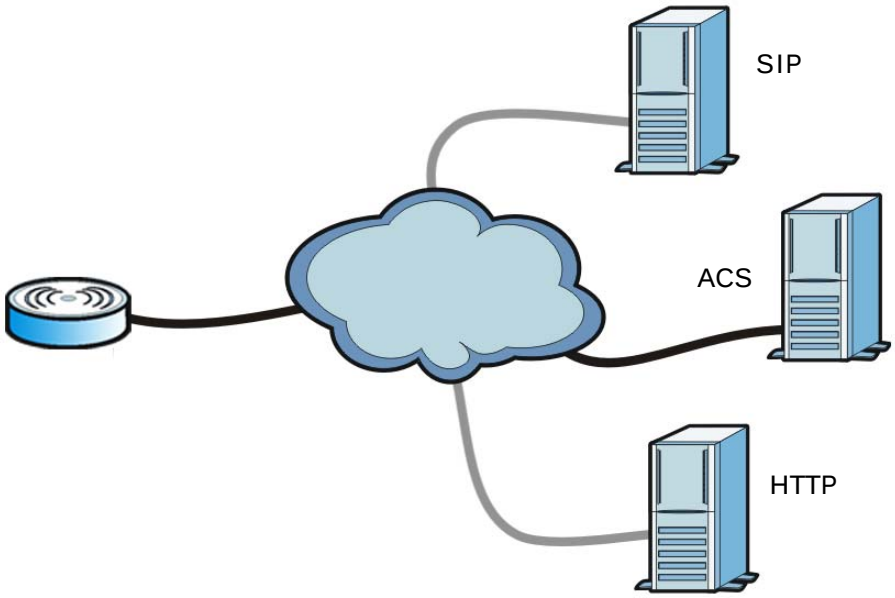
LABEL	DESCRIPTION
Respond to Ping on	Select the interface(s) on which the WiMAX Modem should respond to incoming ping requests. • **Disable** - the WiMAX Modem does not respond to any ping requests. • **LAN** - the WiMAX Modem only responds to ping requests received from the LAN. • **WAN** - the WiMAX Modem only responds to ping requests received from the WAN. • **LAN & WAN** - the WiMAX Modem responds to ping requests received from the LAN or the WAN.
Do not respond to requests for unauthorized services	Select this to prevent outsiders from discovering your WiMAX Modem by sending requests to unsupported port numbers. If an outside user attempts to probe an unsupported port on your WiMAX Modem, an ICMP response packet is automatically returned. This allows the outside user to know the WiMAX Modem exists. Your WiMAX Modem supports anti-probing, which prevents the ICMP response packet from being sent. This keeps outsiders from discovering your WiMAX Modem when unsupported ports are probed. If you clear this, your WiMAX Modem replies with an ICMP Port Unreachable packet for a port probe on unused UDP ports and with a TCP Reset packet for a port probe on unused TCP ports.
Apply	Click to save your changes.
Reset	Click to restore your previously saved settings.

18.8 TR0-69

TR-069 is an abbreviation of “Technical Reference 069”, a protocol designed to facilitate the remote management of Customer Premise Equipement (CPE), such as the WiMAX Modem. It can be managed over a WAN by means of an Auto Configuration Server (ACS). TR-069 is based on sending Remote Procedure Calls (RPCs) between the ACS and the client device. RPCs are sent in Extensible Markup Language (XML) format over HTTP or HTTPS.

An administrator can use an ACS to remotely set up the WiMAX Modem, modify its settings, perform firmware upgrades, and monitor and diagnose it. In order to do so, you must enable the TR-069 feature on your WiMAX Modem and then configure it appropriately. (The ACS server which it will use must also be configured by its administrator.)

Figure 94 TR-069 Example

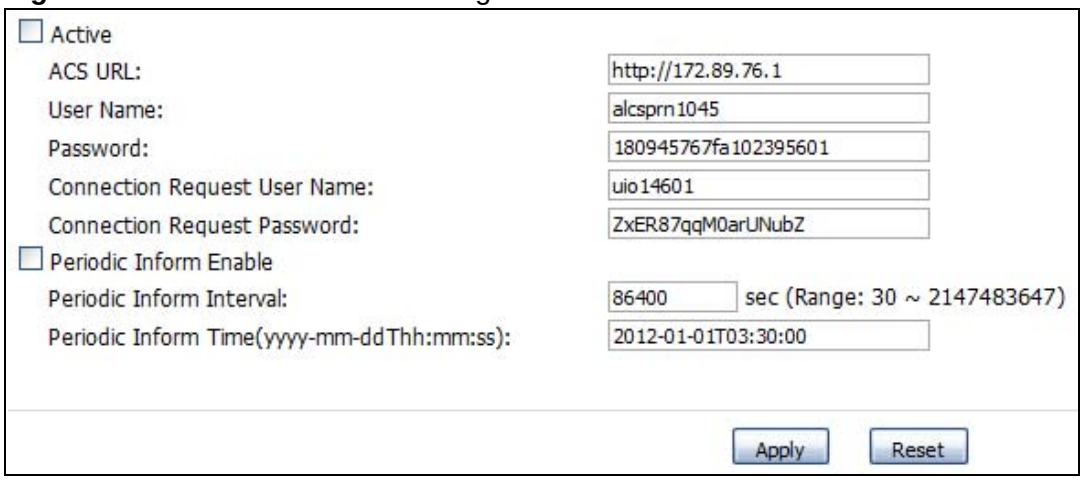


In this example, the WiMAX Modem receives data from at least 3 sources: A SIP server for handling voice calls, an HTTP server for handling web services, and an ACS, for configuring the WiMAX Modem remotely. All three servers are owned and operated by the client’s Internet Service Provider. However, without the configuration settings from the ACS, the WiMAX Modem cannot access the other two servers. Once the WiMAX Modem receives its configuration settings and implements them, it can connect to the other servers. If the settings change, it will once again be unable to connect until it receives its updates from the ACS.

The WiMAX Modem can be configured to periodically check for updates from the auto-configuration server so that the end user need not be worried about it.

Click **TOOLS > Remote Management > TR069** to access this screen. Use this screen to open WiMAX Modem's auto-configuration and dynamic service configuration options.

Figure 95 TOOLS > Remote Management > TR069



The following table describes the labels in this screen.

Table 78 TOOLS > Remote Management > TR069

LABEL	DESCRIPTION
Active	Select this option to turn on the WiMAX Modem's TR-069 feature. Note: If this feature is not enabled then the WiMAX Modem cannot be managed remotely.
ACS URL	Enter the URL or IP address of the auto-configuration server.
User Name	Enter the user name sent when the WiMAX Modem connects to the ACS and which is used for authentication. You can enter up to 31 alphanumeric characters (a-z, A-Z, 0-9) and underscores but spaces are not allowed.
Password	Enter the password sent when the WiMAX Modem connects to an ACS and which is used for authentication. You can enter up to 31 alphanumeric characters (a-z, A-Z, 0-9) and underscores but spaces are not allowed.
Connection Request User Name	Enter the connection request user name that the ACS must send to the WiMAX Modem when it requests a connection. You can enter up to 31 alphanumeric characters (a-z, A-Z, 0-9) and underscores but spaces are not allowed. Note: This must be provided by the ACS administrator.
Connection Request Password	Enter the connection request password that the ACS must send to the WiMAX Modem when it requests a connection. You can enter up to 31 alphanumeric characters (a-z, A-Z, 0-9) and underscores but spaces are not allowed. Note: This must be provided by the ACS administrator.

Table 78 TOOLS > Remote Management > TR069

LABEL	DESCRIPTION
Periodic Inform Enable	Select this to allow the WiMAX Modem to periodically connect to the ACS and check for configuration updates. If you do not enable this feature then the WiMAX Modem can only be updated automatically when the ACS initiates contact with it and if you selected the **Active** checkbox on this screen.
Periodic Inform Interval	Enter the time interval (in seconds) at which the WiMAX Modem connects to the auto-configuration server.
Periodic Inform Time	Enter a time interval that the WiMAX Modem will trigger a periodic inform interval. This works in tandem with the **Periodic Inform Interval** and is not mutually exclusive of it. The **Periodic Inform Time** must be in the following format: yyyy-mm-ddThh:mm:ss where yyyy is a four digit year (“2009”), mm is a two digit month (01~12), dd is a two digit day (01~28), hh is a two-digit hour in 24-hour format (01~24), mm is a two digit minutes value (01-60) and ss is a two digit seconds value (01-60). Note: You must separate the day information from the hour information with a “T”. This feature gives the WiMAX Modem a baseline from which to begin calculating when each periodic inform happens. If the inform time is set for some point in the past, the WiMAX Modem interpolates the inform interval forward to the current time and begins its periodic inform at the appropriate time based on this interpolation. If the inform time is set for some point in the future, then the WiMAX Modem interpolates backwards to the current time and actually begins at the appropriate time based on this interpolation.
Apply	Click to save your changes.
Reset	Click to restore your previously saved settings.

19

QoS

19.1 Overview

Quality of Service (QoS) refers to both a network's ability to deliver data with minimum delay, and the networking methods used to control the use of bandwidth. Without QoS, all traffic data is equally likely to be dropped when the network is congested. This can cause a reduction in network performance and make the network inadequate for time-critical application such as video-on-demand.

19.2 General

Click **TOOLS** > **QoS** to open the screen as shown next. Use this screen to enable or disable QoS.

Figure 96 QoS > General

The following table describes the labels in this screen.

Table 79 TOOLS > QoS > General

LABEL	DESCRIPTION
Active QoS	Select this to enable QoS for the WiMAX Modem. Selecting this may improve network performance, especially if you are using VoIP applications or are playing online video games.
Apply	Click to save your changes.
Reset	Click to restore your previously saved settings.

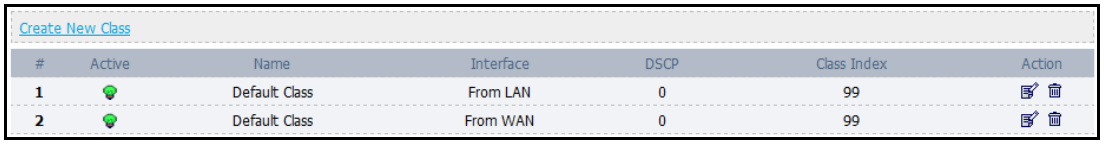
19.3 Class Setup

Use this screen to add, edit or delete QoS classifiers. A classifier groups traffic into data flows according to specific criteria such as the source address, destination address, source port number, destination port number or incoming interface. For example, you can configure a classifier to select traffic from the same protocol port (such as Telnet) to form a flow.

You can give different priorities to traffic that the WiMAX Modem forwards out through the WAN interface. Give high priority to voice and video to make them run more smoothly. Similarly, give low priority to many large file downloads so that they do not reduce the quality of other applications.

Click **TOOLS > QoS > Class Setup** to open the following screen.

Figure 97 QoS > Class Setup



The following table describes the labels in this screen.

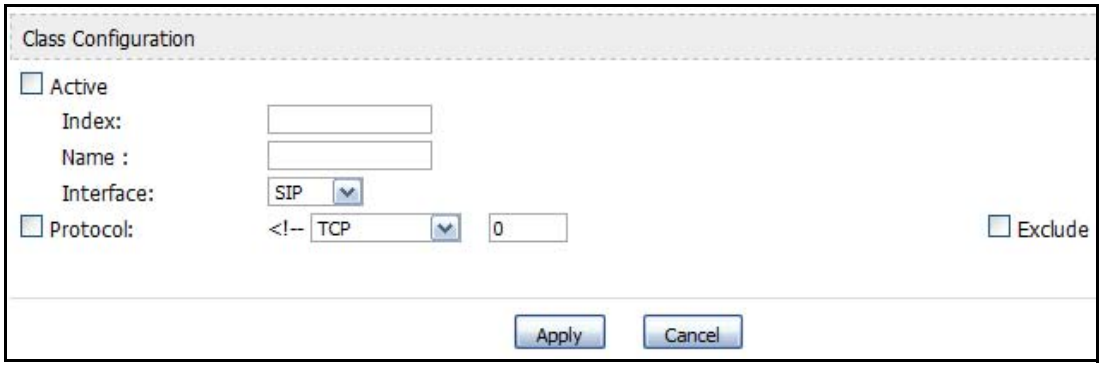
Table 80 QoS Class Setup

LABEL	DESCRIPTION
Create New Class	Click this button to create a new class.
#	This field displays the index number of the class.
Active	This field indicates whether the QoS class is enabled or not.
Name	This field indicates the name of the class.
Interface	This field indicates the Ethernet port on which traffic is being monitored and prioritized.
DSCP	This field indicates the Differentiated Services Code Point (DSCP) value for the associated class.
Class Index	This field indicates the index for this QoS class. Classes are implemented based on index number, from lowest to highest.
Action	Click the **Edit** icon to go to the screen where you can edit the rule. Click the **Delete** icon to delete an existing rule. Note that subsequent rules move up by one when you take this action.
Apply	Click this button to save your changes back to the WiMAX Modem.
Cancel	Click this button to begin configuring this screen afresh.

19.3.1 Class Configuration

Click the **Create New Class** button or the edit icon in the **Class Setup** screen to configure a classifier.

Figure 98 QoS > Class Setup > Class Configuration



The following table describes the labels in this screen.

Table 81 QoS Class Setup

LABEL	DESCRIPTION
Class Configuration	
Active	Select this to make a class active.
Index	Enter an index number for the class. Similar classes are processed in order of index number, from lowest to highest.
Name	Enter a descriptive name of up to 20 printable English keyboard characters, including spaces.
Interface	Select an interface to which the class will apply: • **From WAN** - The class is applied to all packets incoming from the WAN (Wide Area Network). • **From LAN** - The class is applied to all packets outgoing from the LAN (Local Area Network).
Protocol	Select a protocol. Options are: **TCP**, **UDP** and **User Defined**.
Apply	Click this button to save your changes back to the WiMAX Modem.
Cancel	Click this button to begin configuring this screen afresh.

20

The Logs Screens

20.1 Overview

Use the **TOOLS > Logs** screens to look at log entries and alerts and to configure the WiMAX Modem's log and alert settings.

For a list of log messages, see Section 20.4 on page 225.

20.1.1 What You Can Do in This Chapter

- The **View Logs** screen (Section 20.2 on page 221) lets you look at log entries and alerts.
- The **Log Settings** screen (Section 20.3 on page 223) lets you configure where the WiMAX Modem sends logs and alerts, the schedule for sending logs, and which logs and alerts are sent or recorded.

20.1.2 What You Need to Know

The following terms and concepts may help as you read through this chapter.

Alerts

An alert is a type of log that warrants more serious attention. Some categories such as **System Errors** consist of both logs and alerts.

Syslog Logs

There are two types of syslog: event logs and traffic logs.

The device generates an event log when a system event occurs, for example, when a user logs in or the device is under attack. The device generates a traffic log when a "session" is terminated.

A traffic log summarizes the session's type, when it started and stopped the amount of traffic that was sent and received and so on. An external log analyzer

can reconstruct and analyze the traffic flowing through the device after collecting the traffic logs.

Table 82 Syslog Logs

LOG MESSAGE	DESCRIPTION
Event Log: <Facility*8 + Severity>Mon dd hr:mm:ss hostname src="<srcIP:srcPort>" dst="<dstIP:dstPort>" msg="<msg>" note="<note>" devID="<mac address>" cat="<category>"	This message is sent by the system ("RAS" displays as the system name if you haven't configured one) when the router generates a syslog. The facility is defined in the **Log Settings** screen. The severity is the log's syslog class. The definition of messages and notes are defined in the various log charts throughout this appendix. The "devID" is the MAC address of the router's LAN port. The "cat" is the same as the category in the router's logs.
Traffic Log: <Facility*8 + Severity>Mon dd hr:mm:ss hostname src="<srcIP:srcPort>" dst="<dstIP:dstPort>" msg="Traffic Log" note="Traffic Log" devID="<mac address>" cat="Traffic Log" duration=seconds sent=sentBytes rcvd=receiveBytes dir="<from:to>" protoID=IPProtocolID proto="serviceName" trans="IPSec/Normal"	This message is sent by the device when the connection (session) is closed. The facility is defined in the Log Settings screen. The severity is the traffic log type. The message and note always display "Traffic Log". The "proto" field lists the service name. The "dir" field lists the incoming and outgoing interfaces ("LAN:LAN", "LAN:WAN", "LAN:DEV" for example).

The following table shows RFC-2408 ISAKMP payload types that the log displays. Please refer to the RFC for detailed information on each type.

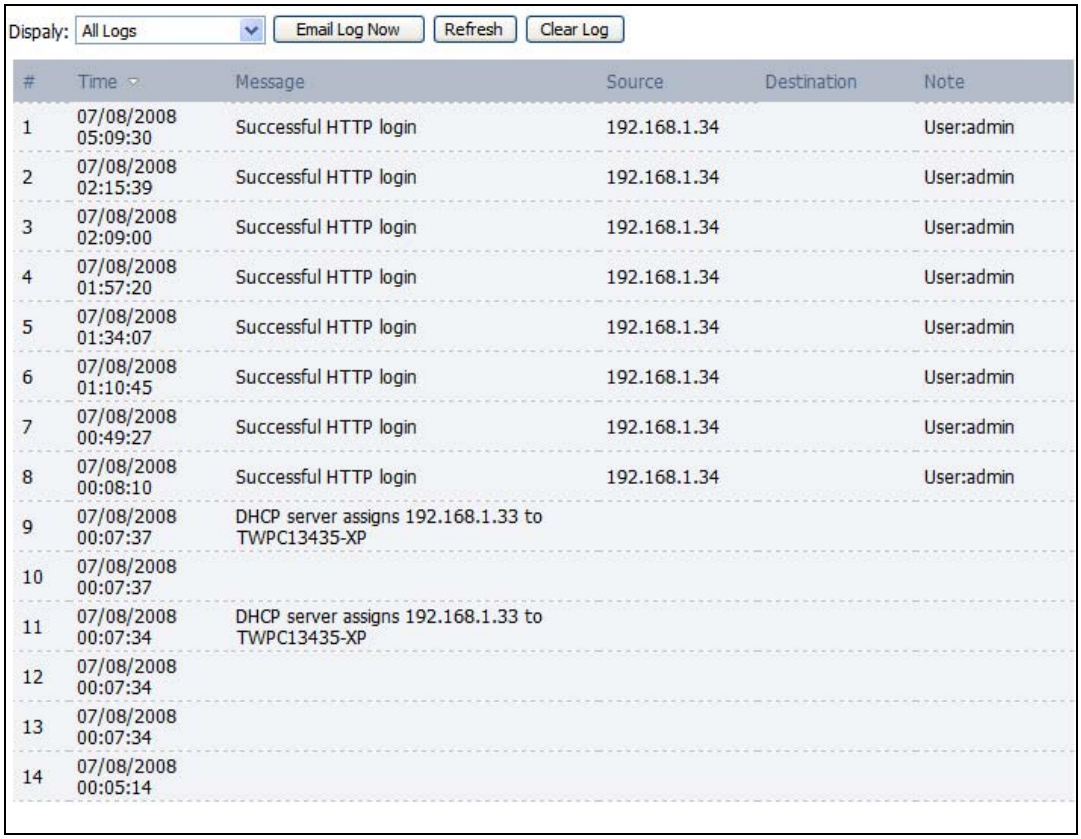
Table 83 RFC-2408 ISAKMP Payload Types

LOG DISPLAY	PAYLOAD TYPE
SA	Security Association
PROP	Proposal
TRANS	Transform
KE	Key Exchange
ID	Identification
CER	Certificate
CER_REQ	Certificate Request
HASH	Hash
SIG	Signature
NONCE	Nonce
NOTFY	Notification
DEL	Delete
VID	Vendor ID

20.2 View Logs

Click **TOOLS > Logs > View Log** to access this screen. Use this screen to look at log entries and alerts. Alerts are written in red.

Figure 99 TOOLS > Logs > View Logs



#	Time	Message	Source	Destination	Note
1	07/08/2008 05:09:30	Successful HTTP login	192.168.1.34		User:admin
2	07/08/2008 02:15:39	Successful HTTP login	192.168.1.34		User:admin
3	07/08/2008 02:09:00	Successful HTTP login	192.168.1.34		User:admin
4	07/08/2008 01:57:20	Successful HTTP login	192.168.1.34		User:admin
5	07/08/2008 01:34:07	Successful HTTP login	192.168.1.34		User:admin
6	07/08/2008 01:10:45	Successful HTTP login	192.168.1.34		User:admin
7	07/08/2008 00:49:27	Successful HTTP login	192.168.1.34		User:admin
8	07/08/2008 00:08:10	Successful HTTP login	192.168.1.34		User:admin
9	07/08/2008 00:07:37	DHCP server assigns 192.168.1.33 to TWPC13435-XP			
10	07/08/2008 00:07:37				
11	07/08/2008 00:07:34	DHCP server assigns 192.168.1.33 to TWPC13435-XP			
12	07/08/2008 00:07:34				
13	07/08/2008 00:07:34				
14	07/08/2008 00:05:14				

Click a column header to sort log entries in descending (later-to-earlier) order. Click again to sort in ascending order. The small triangle next to a column header indicates how the table is currently sorted (pointing downward is descending; pointing upward is ascending).

The following table describes the labels in this screen.

Table 84 TOOLS > Logs > View Logs

LABEL	DESCRIPTION
Display	Select a category whose log entries you want to view. To view all logs, select **All Logs**. The list of categories depends on what log categories are selected in the **Log Settings** page.
Email Log Now	Click this to send the log screen to the e-mail address specified in the **Log Settings** page.
Refresh	Click to renew the log screen.
Clear Log	Click to clear all the log entries, regardless of what is shown on the log screen.

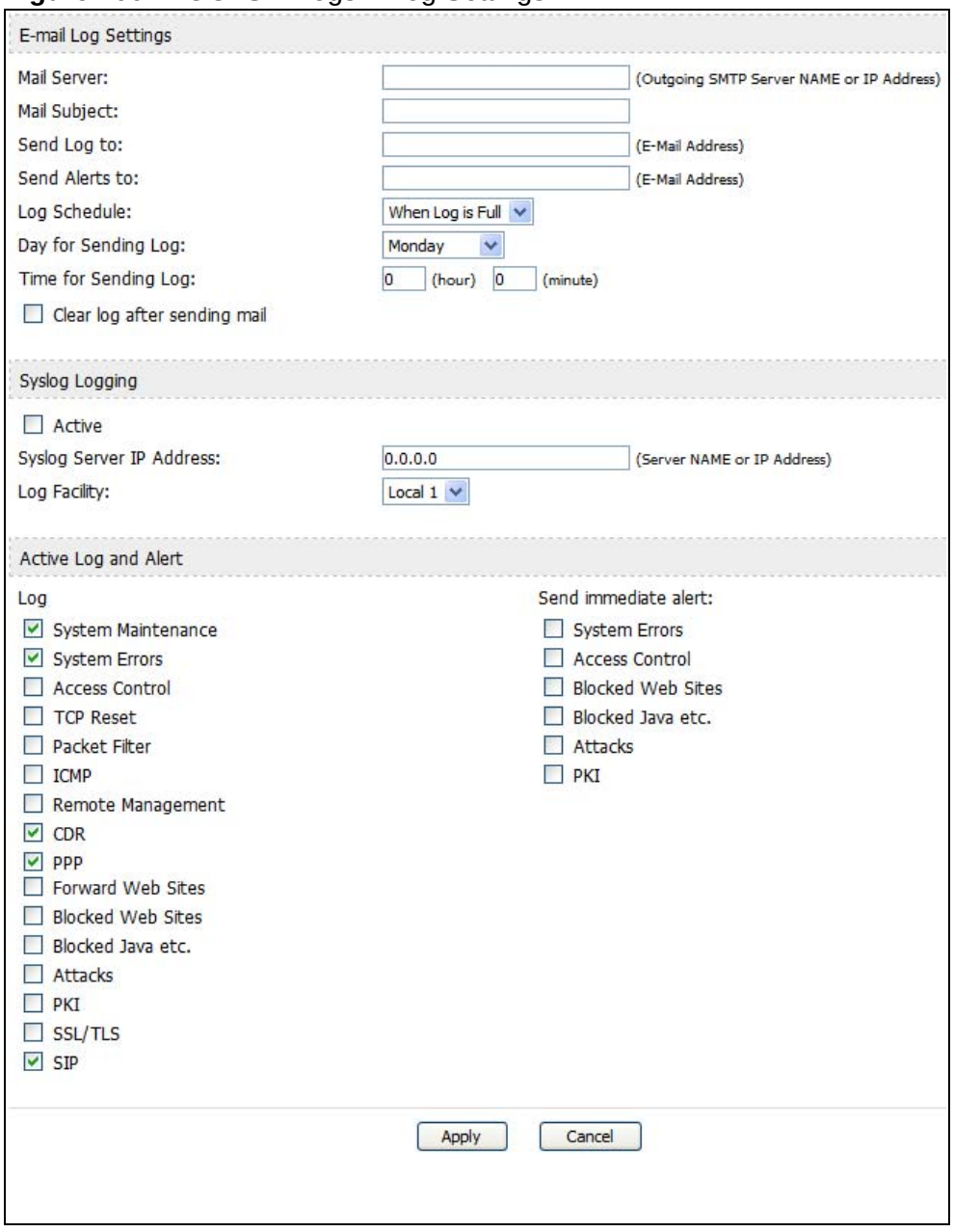
Table 84 TOOLS > Logs > View Logs (continued)

LABEL	DESCRIPTION
#	The number of the item in this list.
Time	This field displays the time the log entry was recorded.
Message	This field displays the reason for the log entry. See Section 20.4 on page 225.
Source	This field displays the source IP address and the port number of the incoming packet. In many cases, some or all of this information may not be available.
Destination	This field lists the destination IP address and the port number of the incoming packet. In many cases, some or all of this information may not be available.
Note	This field displays additional information about the log entry.

20.3 Log Settings

Click **TOOLS > Logs > Log Settings** to configure where the WiMAX Modem sends logs and alerts, the schedule for sending logs, and which logs and alerts are sent or recorded.

Figure 100 TOOLS > Logs > Log Settings



The following table describes the labels in this screen.

Table 85 TOOLS > Logs > Log Settings

LABEL	DESCRIPTION
E-mail Log Settings	
Mail Server	Enter the server name or the IP address of the mail server the WiMAX Modem should use to e-mail logs and alerts. Leave this field blank if you do not want to send logs or alerts by e-mail.
Mail Subject	Enter the subject line used in e-mail messages the WiMAX Modem sends.
Send Log to	Enter the e-mail address to which log entries are sent by e-mail. Leave this field blank if you do not want to send logs by e-mail.
Send Alerts to	Enter the e-mail address to which alerts are sent by e-mail. Leave this field blank if you do not want to send alerts by e-mail.
Log Schedule	Select the frequency with which the WiMAX Modem should send log messages by e-mail. • Daily • Weekly • Hourly • When Log is Full • None. If the **Weekly** or the **Daily** option is selected, specify a time of day when the E-mail should be sent. If the **Weekly** option is selected, then also specify which day of the week the E-mail should be sent. If the **When Log is Full** option is selected, an alert is sent when the log fills up. If you select **None**, no log messages are sent.
Day for Sending Log	This field is only available when you select **Weekly** in the **Log Schedule** field. Select which day of the week to send the logs.
Time for Sending Log	This field is only available when you select **Daily** or **Weekly** in the **Log Schedule** field. Enter the time of day in 24-hour format (for example 23:00 equals 11:00 pm) to send the logs.
Clear log after sending mail	Select this to clear all logs and alert messages after logs are sent by e-mail.
Syslog Logging	
Active	Select this to enable syslog logging.
Syslog Server IP Address	Enter the server name or IP address of the syslog server that logs the selected categories of logs.
Log Facility	Select a location. The log facility allows you to log the messages in different files in the syslog server. See the documentation of your syslog for more details.
Active Log and Alert	
Log	Select the categories of logs that you want to record.
Send immediate alert	Select the categories of alerts that you want the WiMAX Modem to send immediately.

Table 85 TOOLS > Logs > Log Settings

LABEL	DESCRIPTION
Apply	Click to save your changes.
Cancel	Click to return to the previous screen without saving your changes.

20.4 Log Message Descriptions

The following tables provide descriptions of example log messages.

Table 86 System Error Logs

LOG MESSAGE	DESCRIPTION
WAN connection is down.	The WAN connection is down. You cannot access the network through this interface.
%s exceeds the max. number of session per host!	This attempt to create a NAT session exceeds the maximum number of NAT session table entries allowed to be created per host.

Table 87 System Maintenance Logs

LOG MESSAGE	DESCRIPTION
Time calibration is successful	The device has adjusted its time based on information from the time server.
Time calibration failed	The device failed to get information from the time server.
WAN interface gets IP: %s	The WAN interface got a new IP address from the DHCP or PPPoE server.
DHCP client gets %s	A DHCP client got a new IP address from the DHCP server.
DHCP client IP expired	A DHCP client's IP address has expired.
DHCP server assigns %s	The DHCP server assigned an IP address to a client.
Successful WEB login	Someone has logged on to the device's web configurator interface.
WEB login failed	Someone has failed to log on to the device's web configurator interface.
TELNET Login Successfully	Someone has logged on to the router via telnet.
TELNET Login Fail	Someone has failed to log on to the router via telnet.
Successful FTP login	Someone has logged on to the device via ftp.
FTP login failed	Someone has failed to log on to the device via ftp.
NAT Session Table is Full!	The maximum number of NAT session table entries has been exceeded and the table is full.
Time initialized by Daytime Server	The device got the time and date from the Daytime server.

Table 87 System Maintenance Logs (continued)

LOG MESSAGE	DESCRIPTION
Time initialized by Time server	The device got the time and date from the time server.
Time initialized by NTP server	The device got the time and date from the NTP server.
Connect to Daytime server fail	The device was not able to connect to the Daytime server.
Connect to Time server fail	The device was not able to connect to the Time server.
Connect to NTP server fail	The device was not able to connect to the NTP server.
Too large ICMP packet has been dropped	The device dropped an ICMP packet that was too large.
Configuration Change: PC = 0x%x, Task ID = 0x%x	The device is saving configuration changes.

Table 88 Access Control Logs

LOG MESSAGE	DESCRIPTION
Firewall default policy: [TCP | UDP | IGMP | ESP | GRE | OSPF] <Packet Direction>	Attempted TCP/UDP/IGMP/ESP/GRE/OSPF access matched the default policy and was blocked or forwarded according to the default policy's setting.
Firewall rule [NOT] match:[TCP | UDP | IGMP | ESP | GRE | OSPF] <Packet Direction>, <rule:%d>	Attempted TCP/UDP/IGMP/ESP/GRE/OSPF access matched (or did not match) a configured firewall rule (denoted by its number) and was blocked or forwarded according to the rule.
Triangle route packet forwarded: [TCP | UDP | IGMP | ESP | GRE | OSPF]	The firewall allowed a triangle route session to pass through.
Packet without a NAT table entry blocked: [TCP | UDP | IGMP | ESP | GRE | OSPF]	The router blocked a packet that didn't have a corresponding NAT table entry.
Router sent blocked web site message: TCP	The router sent a message to notify a user that the router blocked access to a web site that the user requested.
Exceed maximum sessions per host (%d).	The device blocked a session because the host's connections exceeded the maximum sessions per host.
Firewall allowed a packet that matched a NAT session: [TCP | UDP]	A packet from the WAN (TCP or UDP) matched a cone NAT session and the device forwarded it to the LAN.

Table 89 TCP Reset Logs

LOG MESSAGE	DESCRIPTION
Under SYN flood attack, sent TCP RST	The router sent a TCP reset packet when a host was under a SYN flood attack (the TCP incomplete count is per destination host.)
Exceed TCP MAX incomplete, sent TCP RST	The router sent a TCP reset packet when the number of TCP incomplete connections exceeded the user configured threshold. (the TCP incomplete count is per destination host.)
Peer TCP state out of order, sent TCP RST	The router sent a TCP reset packet when a TCP connection state was out of order.Note: The firewall refers to RFC793 Figure 6 to check the TCP state.
Firewall session time out, sent TCP RST	The router sent a TCP reset packet when a dynamic firewall session timed out. The default timeout values are as follows: ICMP idle timeout: 3 minutes UDP idle timeout: 3 minutes TCP connection (three way handshaking) timeout: 270 seconds TCP FIN-wait timeout: 2 MSL (Maximum Segment Lifetime set in the TCP header). TCP idle (established) timeout (s): 150 minutes TCP reset timeout: 10 seconds
Exceed MAX incomplete, sent TCP RST	The router sent a TCP reset packet when the number of incomplete connections (TCP and UDP) exceeded the user-configured threshold. (Incomplete count is for all TCP and UDP connections through the firewall.)Note: When the number of incomplete connections (TCP + UDP) > “Maximum Incomplete High”, the router sends TCP RST packets for TCP connections and destroys TOS (firewall dynamic sessions) until incomplete connections < “Maximum Incomplete Low”.
Access block, sent TCP RST	The router sends a TCP RST packet and generates this log if you turn on the firewall TCP reset mechanism (via CI command: `sys firewall tcprst`).

Table 90 Packet Filter Logs

LOG MESSAGE	DESCRIPTION
[TCP | UDP | ICMP | IGMP | Generic] packet filter matched (set: %d, rule: %d)	Attempted access matched a configured filter rule (denoted by its set and rule number) and was blocked or forwarded according to the rule.

For type and code details, see Table 97 on page 231.

Table 91 ICMP Logs

LOG MESSAGE	DESCRIPTION
Firewall default policy: ICMP <Packet Direction>, <type:%d>, <code:%d>	ICMP access matched the default policy and was blocked or forwarded according to the user's setting.
Firewall rule [NOT] match: ICMP <Packet Direction>, <rule:%d>, <type:%d>, <code:%d>	ICMP access matched (or didn't match) a firewall rule (denoted by its number) and was blocked or forwarded according to the rule.
Triangle route packet forwarded: ICMP	The firewall allowed a triangle route session to pass through.
Packet without a NAT table entry blocked: ICMP	The router blocked a packet that didn't have a corresponding NAT table entry.
Unsupported/out-of-order ICMP: ICMP	The firewall does not support this kind of ICMP packets or the ICMP packets are out of order.
Router reply ICMP packet: ICMP	The router sent an ICMP reply packet to the sender.

Table 92 PPP Logs

LOG MESSAGE	DESCRIPTION
ppp:LCP Starting	The PPP connection's Link Control Protocol stage has started.
ppp:LCP Opening	The PPP connection's Link Control Protocol stage is opening.
ppp:CHAP Opening	The PPP connection's Challenge Handshake Authentication Protocol stage is opening.
ppp:IPCP Starting	The PPP connection's Internet Protocol Control Protocol stage is starting.
ppp:IPCP Opening	The PPP connection's Internet Protocol Control Protocol stage is opening.
ppp:LCP Closing	The PPP connection's Link Control Protocol stage is closing.
ppp:IPCP Closing	The PPP connection's Internet Protocol Control Protocol stage is closing.

Table 93 UPnP Logs

LOG MESSAGE	DESCRIPTION
UPnP pass through Firewall	UPnP packets can pass through the firewall.

Table 94 Content Filtering Logs

LOG MESSAGE	DESCRIPTION
%s: Keyword blocking	The content of a requested web page matched a user defined keyword.
%s: Not in trusted web list	The web site is not in a trusted domain, and the router blocks all traffic except trusted domain sites.
%s: Forbidden Web site	The web site is in the forbidden web site list.
%s: Contains ActiveX	The web site contains ActiveX.
%s: Contains Java applet	The web site contains a Java applet.
%s: Contains cookie	The web site contains a cookie.
%s: Proxy mode detected	The router detected proxy mode in the packet.
%s: Trusted Web site	The web site is in a trusted domain.
%s	When the content filter is not on according to the time schedule:
Waiting content filter server timeout	The external content filtering server did not respond within the timeout period.
DNS resolving failed	The WiMAX Modem cannot get the IP address of the external content filtering via DNS query.
Creating socket failed	The WiMAX Modem cannot issue a query because TCP/UDP socket creation failed, port:port number.
Connecting to content filter server fail	The connection to the external content filtering server failed.
License key is invalid	The external content filtering license key is invalid.

For type and code details, see Table 97 on page 231.

Table 95 Attack Logs

LOG MESSAGE	DESCRIPTION
attack [TCP | UDP | IGMP | ESP | GRE | OSPF]	The firewall detected a TCP/UDP/IGMP/ESP/GRE/OSPF attack.
attack ICMP (type:%d, code:%d)	The firewall detected an ICMP attack.
land [TCP | UDP | IGMP | ESP | GRE | OSPF]	The firewall detected a TCP/UDP/IGMP/ESP/GRE/OSPF land attack.
land ICMP (type:%d, code:%d)	The firewall detected an ICMP land attack.
ip spoofing - WAN [TCP | UDP | IGMP | ESP | GRE | OSPF]	The firewall detected an IP spoofing attack on the WAN port.

Table 95 Attack Logs (continued)

LOG MESSAGE	DESCRIPTION
ip spoofing - WAN ICMP (type:%d, code:%d)	The firewall detected an ICMP IP spoofing attack on the WAN port.
icmp echo : ICMP (type:%d, code:%d)	The firewall detected an ICMP echo attack.
syn flood TCP	The firewall detected a TCP syn flood attack.
ports scan TCP	The firewall detected a TCP port scan attack.
teardrop TCP	The firewall detected a TCP teardrop attack.
teardrop UDP	The firewall detected an UDP teardrop attack.
teardrop ICMP (type:%d, code:%d)	The firewall detected an ICMP teardrop attack.
illegal command TCP	The firewall detected a TCP illegal command attack.
NetBIOS TCP	The firewall detected a TCP NetBIOS attack.
ip spoofing - no routing entry [TCP | UDP | IGMP | ESP | GRE | OSPF]	The firewall classified a packet with no source routing entry as an IP spoofing attack.
ip spoofing - no routing entry ICMP (type:%d, code:%d)	The firewall classified an ICMP packet with no source routing entry as an IP spoofing attack.
vulnerability ICMP (type:%d, code:%d)	The firewall detected an ICMP vulnerability attack.
traceroute ICMP (type:%d, code:%d)	The firewall detected an ICMP traceroute attack.
ports scan UDP	The firewall detected a UDP port scan attack.
Firewall sent TCP packet in response to DoS attack TCP	The firewall sent TCP packet in response to a DoS attack
ICMP Source Quench ICMP	The firewall detected an ICMP Source Quench attack.
ICMP Time Exceed ICMP	The firewall detected an ICMP Time Exceed attack.
ICMP Destination Unreachable ICMP	The firewall detected an ICMP Destination Unreachable attack.
ping of death. ICMP	The firewall detected an ICMP ping of death attack.
smurf ICMP	The firewall detected an ICMP smurf attack.

Table 96 Remote Management Logs

LOG MESSAGE	DESCRIPTION
Remote Management: FTP denied	Attempted use of FTP service was blocked according to remote management settings.
Remote Management: TELNET denied	Attempted use of TELNET service was blocked according to remote management settings.
Remote Management: HTTP or UPnP denied	Attempted use of HTTP or UPnP service was blocked according to remote management settings.

Table 96 Remote Management Logs

LOG MESSAGE	DESCRIPTION
Remote Management: WWW denied	Attempted use of WWW service was blocked according to remote management settings.
Remote Management: HTTPS denied	Attempted use of HTTPS service was blocked according to remote management settings.
Remote Management: SSH denied	Attempted use of SSH service was blocked according to remote management settings.
Remote Management: ICMP Ping response denied	Attempted use of ICMP service was blocked according to remote management settings.
Remote Management: DNS denied	Attempted use of DNS service was blocked according to remote management settings.

Table 97 ICMP Notes

TYPE	CODE	DESCRIPTION
0		Echo Reply
	0	Echo reply message
3		Destination Unreachable
	0	Net unreachable
	1	Host unreachable
	2	Protocol unreachable
	3	Port unreachable
	4	A packet that needed fragmentation was dropped because it was set to Don't Fragment (DF)
	5	Source route failed
4		Source Quench
	0	A gateway may discard internet datagrams if it does not have the buffer space needed to queue the datagrams for output to the next network on the route to the destination network.
5		Redirect
	0	Redirect datagrams for the Network
	1	Redirect datagrams for the Host
	2	Redirect datagrams for the Type of Service and Network
	3	Redirect datagrams for the Type of Service and Host
8		Echo
	0	Echo message
11		Time Exceeded
	0	Time to live exceeded in transit
	1	Fragment reassembly time exceeded
12		Parameter Problem
	0	Pointer indicates the error
13		Timestamp

Table 97 ICMP Notes (continued)

TYPE	CODE	DESCRIPTION
	0	Timestamp request message
14		Timestamp Reply
	0	Timestamp reply message
15		Information Request
	0	Information request message
16		Information Reply
	0	Information reply message

Table 98 SIP Logs

LOG MESSAGE	DESCRIPTION
SIP Registration Success by SIP:SIP Phone Number	The listed SIP account was successfully registered with a SIP register server.
SIP Registration Fail by SIP:SIP Phone Number	An attempt to register the listed SIP account with a SIP register server was not successful.
SIP UnRegistration Success by SIP:SIP Phone Number	The listed SIP account's registration was deleted from the SIP register server.
SIP UnRegistration Fail by SIP:SIP Phone Number	An attempt to delete the listed SIP account's registration from the SIP register server failed.

Table 99 RTP Logs

LOG MESSAGE	DESCRIPTION
Error, RTP init fail	The initialization of an RTP session failed.
Error, Call fail: RTP connect fail	A VoIP phone call failed because the RTP session could not be established.
Error, RTP connection cannot close	The termination of an RTP session failed.

Table 100 FSM Logs: Caller Side

LOG MESSAGE	DESCRIPTION
VoIP Call Start Ph[Phone Port Number] <- Outgoing Call Number	Someone used a phone connected to the listed phone port to initiate a VoIP call to the listed destination.
VoIP Call Established Ph[Phone Port] -> Outgoing Call Number	Someone used a phone connected to the listed phone port to make a VoIP call to the listed destination.
VoIP Call End Phone[Phone Port]	A VoIP phone call made from a phone connected to the listed phone port has terminated.

Table 101 FSM Logs: Callee Side

LOG MESSAGE	DESCRIPTION
VoIP Call Start from SIP[SIP Port Number]	A VoIP phone call came to the WiMAX Modem from the listed SIP number.
VoIP Call Established Ph[Phone Port] <- Outgoing Call Number	A VoIP phone call was set up from the listed SIP number to the WiMAX Modem.
VoIP Call End Phone[Phone Port]	A VoIP phone call that came into the WiMAX Modem has terminated.

Table 102 Lifeline Logs

LOG MESSAGE	DESCRIPTION
PSTN Call Start	A PSTN call has been initiated.
PSTN Call End	A PSTN call has terminated.
PSTN Call Established	A PSTN call has been set up.

21

The Status Screen

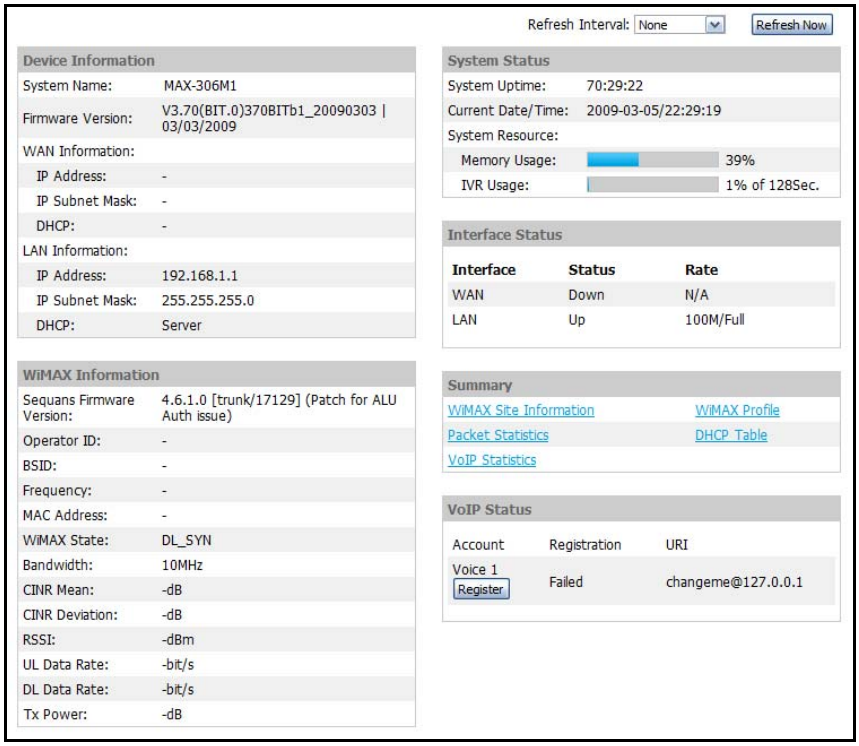
21.1 Overview

Use this screen to view a complete summary of your WiMAX Modem connection status.

21.2 Status Screen

Click the **STATUS** icon in the navigation bar to go to this screen, where you can view the current status of the device, system resources, interfaces (LAN and WAN), and SIP accounts. You can also register and un-register SIP accounts as well as view detailed information from DHCP and statistics from WiMAX, VoIP, bandwidth management, and traffic.

Figure 101 Status



The following tables describe the labels in this screen.

Table 103 Status

LABEL	DESCRIPTION
Refresh Interval	Select how often you want the WiMAX Modem to update this screen.
Refresh Now	Click this to update this screen immediately.
Device Information	
System Name	This field displays the WiMAX Modem system name. It is used for identification. You can change this in the **ADVANCED > System Configuration > General** screen's **System Name** field.
Firmware Version	This field displays the current version of the firmware inside the device. It also shows the date the firmware version was created. You can change the firmware version by uploading new firmware in **ADVANCED > System Configuration > Firmware**.
WAN Information	
IP Address	This field displays the current IP address of the WiMAX Modem in the WAN.
IP Subnet Mask	This field displays the current subnet mask on the WAN.
DHCP	This field displays what DHCP services the WiMAX Modem is using in the WAN. Choices are: **Client** - The WiMAX Modem is a DHCP client in the WAN. Its IP address comes from a DHCP server on the WAN. **None** - The WiMAX Modem is not using any DHCP services in the WAN. It has a static IP address.
LAN Information	
IP Address	This field displays the current IP address of the WiMAX Modem in the LAN.
IP Subnet Mask	This field displays the current subnet mask in the LAN.
DHCP	This field displays what DHCP services the WiMAX Modem is providing to the LAN. You can change this in **ADVANCED > LAN Configuration > DHCP Setup**.
WiMAX Information	
Operator ID	Every WiMAX service provider has a unique Operator ID number, which is broadcast by each base station it owns. You can only connect to the Internet through base stations belonging to your service provider's network.
BSID	This field displays the identification number of the wireless base station to which the WiMAX Modem is connected. Every base station transmits a unique BSID, which identifies it across the network.
Frequency	This field displays the radio frequency of the WiMAX Modem's wireless connection to a base station.
MAC address	This field displays the Media Access Control address of the WiMAX Modem. Every network device has a unique MAC address which identifies it across the network.

Table 103 Status (continued)

LABEL	DESCRIPTION
WiMAX State	This field displays the status of the WiMAX Modem's current connection. • **INIT**: the WiMAX Modem is starting up. • **DL_SYN**: The WiMAX Modem is unable to connect to a base station. • **RANGING**: the WiMAX Modem and the base station are transmitting and receiving information about the distance between them. Ranging allows the WiMAX Modem to use a lower transmission power level when communicating with a nearby base station, and a higher transmission power level when communicating with a distant base station. • **CAP_NEGO**: the WiMAX Modem and the base station are exchanging information about their capabilities. • **AUTH**: the WiMAX Modem and the base station are exchanging security information. • **REGIST**: the WiMAX Modem is registering with a RADIUS server. • **OPERATIONAL**: the WiMAX Modem has successfully registered with the base station. Traffic can now flow between the WiMAX Modem and the base station. • **IDLE**: the WiMAX Modem is in power saving mode, but can connect when a base station alerts it that there is traffic waiting.
Bandwidth	This field shows the size of the bandwidth step the WiMAX Modem uses to connect to a base station in megahertz (MHz).
CINR mean	This field shows the average Carrier to Interference plus Noise Ratio of the current connection. This value is an indication of overall radio signal quality. A higher value indicates a higher signal quality, and a lower value indicates a lower signal quality.
CINR deviation	This field shows the amount of change in the CINR level. This value is an indication of radio signal stability. A lower number indicates a more stable signal, and a higher number indicates a less stable signal.
RSSI	This field shows the Received Signal Strength Indication. This value is a measurement of overall radio signal strength. A higher RSSI level indicates a stronger signal, and a lower RSSI level indicates a weaker signal. A strong signal does not necessarily indicate a good signal: a strong signal may have a low signal-to-noise ratio (SNR).
UL Data Rate	This field shows the number of data packets uploaded from the WiMAX Modem to the base station each second.
DL Data Rate	This field shows the number of data packets downloaded to the WiMAX Modem from the base station each second.
Tx Power	This field shows the output transmission (Tx) level of the WiMAX Modem.
System Status	
System Uptime	This field displays how long the WiMAX Modem has been running since it last started up. The WiMAX Modem starts up when you plug it in, when you restart it (**ADVANCED > System Configuration > Restart**), or when you reset it.
Current Date/ Time	This field displays the current date and time in the WiMAX Modem. You can change this in **SETUP > Time Setting**.

Table 103 Status (continued)

LABEL	DESCRIPTION
Memory Usage	This field displays what percentage of the WiMAX Modem's memory is currently used. The higher the memory usage, the more likely the WiMAX Modem is to slow down. Some memory is required just to start the WiMAX Modem and to run the web configurator. You can reduce the memory usage by disabling some services (see **CPU Usage**); by reducing the amount of memory allocated to NAT and firewall rules (you may have to reduce the number of NAT rules or firewall rules to do so); or by deleting rules in functions such as incoming call policies, speed dial entries, and static routes.
IVR Usage	This field displays what percentage of the WiMAX Modem's IVR memory is currently used. IVR (Interactive Voice Response) refers to the customizable ring tone and on-hold music you set.
Interface Status	
Interface	This column displays each interface of the WiMAX Modem.
Status	This field indicates whether or not the WiMAX Modem is using the interface. For the WAN interface, this field displays **Up** when the WiMAX Modem is connected to a WiMAX network, and **Down** when the WiMAX Modem is not connected to a WiMAX network. For the LAN interface, this field displays **Up** when the WiMAX Modem is using the interface and **Down** when the WiMAX Modem is not using the interface.
Rate	For the LAN ports this displays the port speed and duplex setting. For the WAN interface, it displays the downstream and upstream transmission rate or **N/A** if the WiMAX Modem is not connected to a base station. For the WLAN interface, it displays the transmission rate when WLAN is enabled or **N/A** when WLAN is disabled.
Summary	
Packet Statistics	Click this link to view port status and packet specific statistics.
WiMAX Site Information	Click this link to view details of the radio frequencies used by the WiMAX Modem to connect to a base station.
DHCP Table	Click this link to see details of computers to which the WiMAX Modem has given an IP address.
VoIP Statistics	Click this link to view statistics about your VoIP usage.
WiMAX Profile	Click this link to view details of the current wireless security settings.
VoIP Status	
Account	This column displays each SIP account in the WiMAX Modem.

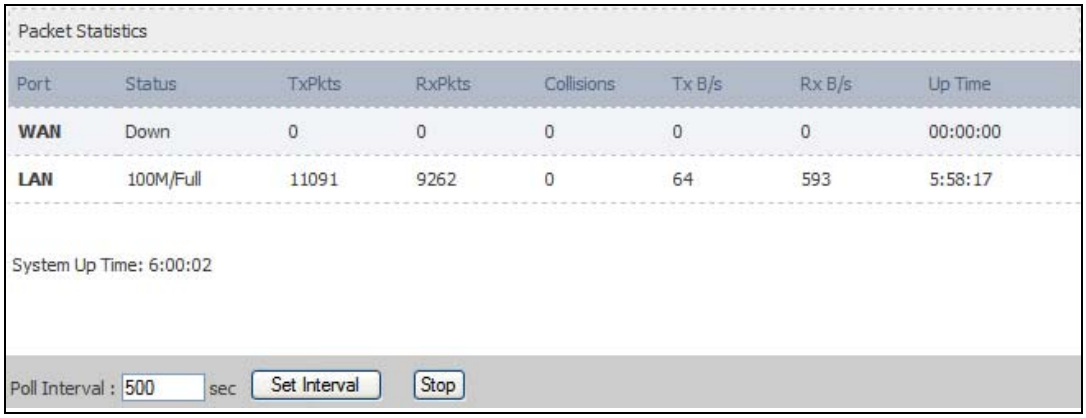
Table 103 Status (continued)

LABEL	DESCRIPTION
Registration	This field displays the current registration status of the SIP account. You have to register SIP accounts with a SIP server to use VoIP. If the SIP account is already registered with the SIP server, Click **Unregister** to delete the SIP account's registration in the SIP server. This does not cancel your SIP account, but it deletes the mapping between your SIP identity and your IP address or domain name. The second field displays **Registered**. If the SIP account is not registered with the SIP server, Click **Register** to have the WiMAX Modem attempt to register the SIP account with the SIP server. The second field displays the reason the account is not registered. **Inactive** - The SIP account is not active. You can activate it in **VOICE > Service Configuration > SIP Settings**. **Register Fail** - The last time the WiMAX Modem tried to register the SIP account with the SIP server, the attempt failed. The WiMAX Modem automatically tries to register the SIP account when you turn on the WiMAX Modem or when you activate it.
URI	This field displays the account number and service domain of the SIP account. You can change these in **VOICE > Service Configuration > SIP Settings**.

21.2.1 Packet Statistics

Click **Status > Packet Statistics** to open this screen. This read-only screen displays information about the data transmission through the WiMAX Modem. To configure these settings, go to the corresponding area in the **Advanced** screens.

Figure 102 Packet Statistics



The following table describes the fields in this screen.

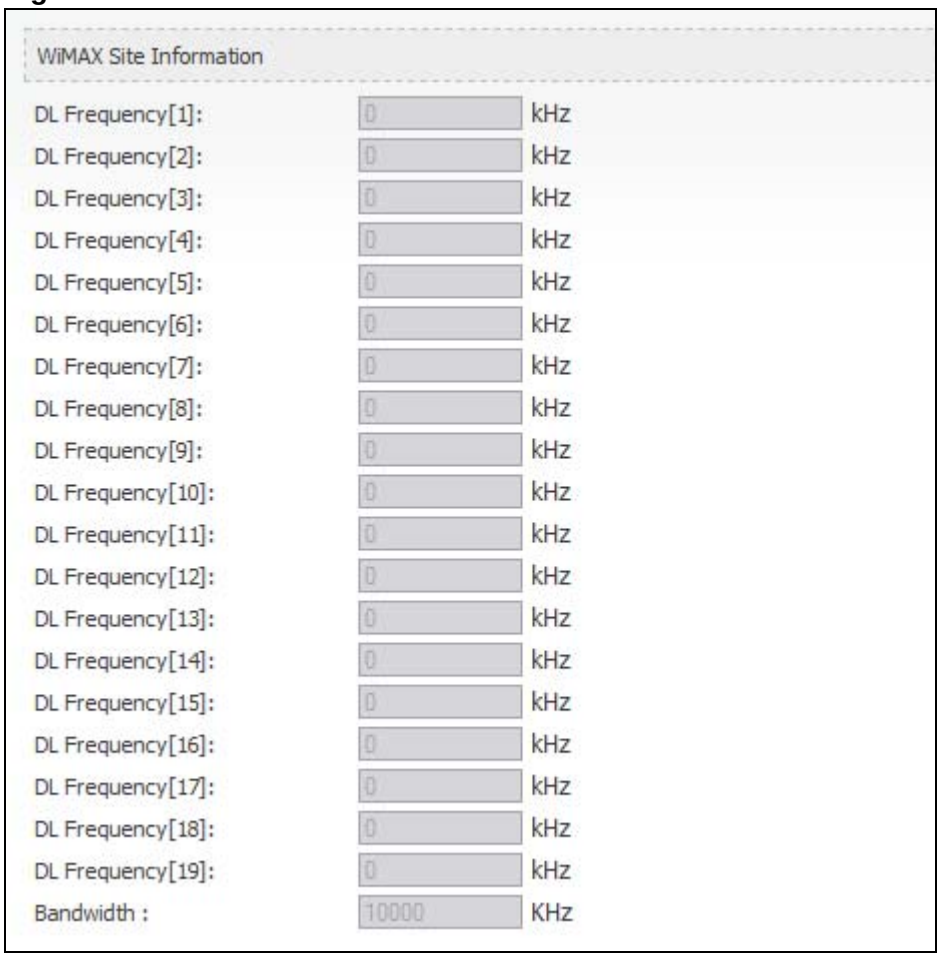
Table 104 Packet Statistics

LABEL	DESCRIPTION
Port	This column displays each interface of the WiMAX Modem.
Status	This field indicates whether or not the WiMAX Modem is using the interface. For the WAN interface, this field displays the port speed and duplex setting when the WiMAX Modem is connected to a WiMAX network, and **Down** when the WiMAX Modem is not connected to a WiMAX network. For the LAN interface, this field displays the port speed and duplex setting when the WiMAX Modem is using the interface and **Down** when the WiMAX Modem is not using the interface. For the WLAN interface, it displays the transmission rate when WLAN is enabled or **Down** when WLAN is disabled.
TxPkts	This field displays the number of packets transmitted on this interface.
RxPkts	This field displays the number of packets received on this interface.
Collisions	This field displays the number of collisions on this port.
Tx B/s	This field displays the number of bytes transmitted in the last second.
Rx B/s	This field displays the number of bytes received in the last second.
Up Time	This field displays the elapsed time this interface has been connected.
System up Time	This is the elapsed time the system has been on.
Poll Interval(s)	Type the time interval for the browser to refresh system statistics.
Set Interval	Click this button to apply the new poll interval you entered in the **Poll Interval** field above.
Stop	Click this button to halt the refreshing of the system statistics.

21.2.2 WiMAX Site Information

Click **Status > WiMAX Site Information** to open this screen. This read-only screen shows WiMAX frequency information for the WiMAX Modem. These settings can be configured in the **ADVANCED > WAN Configuration > WiMAX Configuration** screen.

Figure 103 WiMAX Site Information


WiMAX Site Information
DL Frequency[1]: 0 kHz
DL Frequency[2]: 0 kHz
DL Frequency[3]: 0 kHz
DL Frequency[4]: 0 kHz
DL Frequency[5]: 0 kHz
DL Frequency[6]: 0 kHz
DL Frequency[7]: 0 kHz
DL Frequency[8]: 0 kHz
DL Frequency[9]: 0 kHz
DL Frequency[10]: 0 kHz
DL Frequency[11]: 0 kHz
DL Frequency[12]: 0 kHz
DL Frequency[13]: 0 kHz
DL Frequency[14]: 0 kHz
DL Frequency[15]: 0 kHz
DL Frequency[16]: 0 kHz
DL Frequency[17]: 0 kHz
DL Frequency[18]: 0 kHz
DL Frequency[19]: 0 kHz
Bandwidth : 10000 KHz

The following table describes the labels in this screen.

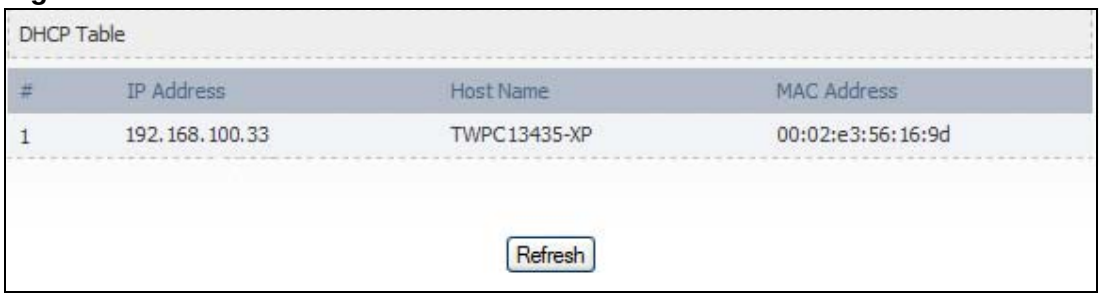
Table 105 WiMAX Site Information

LABEL	DESCRIPTION
DL Frequency [1] ~ [19]	These fields show the downlink frequency settings in kilohertz (kHz). These settings determine how the WiMAX Modem searches for an available wireless connection.

21.2.3 DHCP Table

Click **Status > DHCP Table** to open this screen. This read-only screen shows the IP addresses, Host Names and MAC addresses of the devices currently connected to the WiMAX Modem. These settings can be configured in the **ADVANCED > LAN Configuration > DHCP Setup** screen.

Figure 104 DHCP Table



Each field is described in the following table.

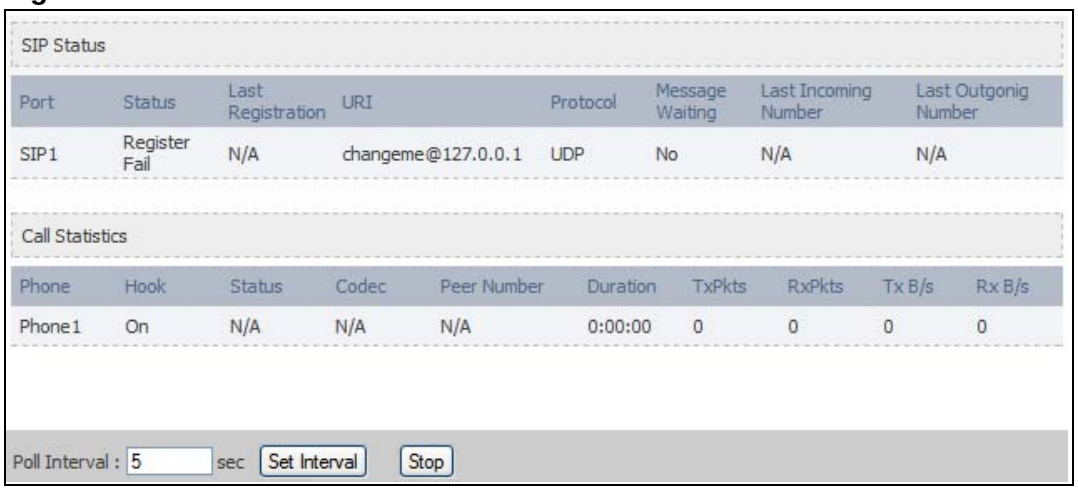
Table 106 DHCP Table

LABEL	DESCRIPTION
#	The number of the item in this list.
IP Address	This field displays the IP address the WiMAX Modem assigned to a computer in the network.
Host Name	This field displays the system name of the computer to which the WiMAX Modem assigned the IP address.
MAC Address	This field displays the MAC address of the computer to which the WiMAX Modem assigned the IP address.
Refresh	Click this button to update the table data.

21.2.4 VoIP Statistics

Click **Status > DHCP Table** to open this screen. This read-only screen shows SIP registration information, status of calls and VoIP traffic statistics. These settings can be configured in the **VOICE > Service Configuration > SIP Setting** screen.

Figure 105 VoIP Statistics



Each field is described in the following table.

Table 107 VoIP Statistics

LABEL	DESCRIPTION
SIP Status	
Port	This column displays each SIP account in the WiMAX Modem.
Status	This field displays the current registration status of the SIP account. You can change this in the **Status** screen. **Registered** - The SIP account is registered with a SIP server. **Register Fail** - The last time the WiMAX Modem tried to register the SIP account with the SIP server, the attempt failed. The WiMAX Modem automatically tries to register the SIP account when you turn on the WiMAX Modem or when you activate it. **Inactive** - The SIP account is not active. You can activate it in **VOICE > SIP > SIP Settings**.
Last Registration	This field displays the last time you successfully registered the SIP account. It displays **N/A** if you never successfully registered this account.
URI	This field displays the account number and service domain of the SIP account. You can change these in **VOICE > SIP > SIP Settings**.
Protocol	This field displays the transport protocol the SIP account uses. SIP accounts always use UDP.
Message Waiting	This field indicates whether or not there are any messages waiting for the SIP account.
Last Incoming Number	This field displays the last number that called the SIP account. It displays **N/A** if no number has ever dialed the SIP account.

Table 107 VoIP Statistics

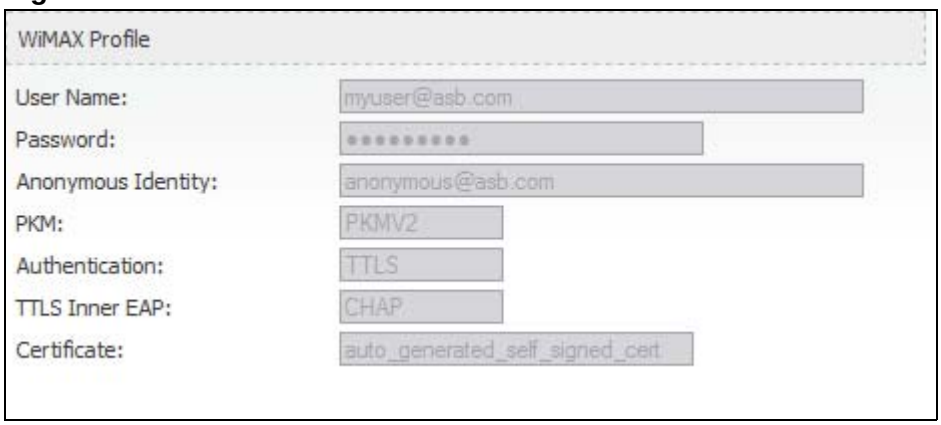
LABEL	DESCRIPTION
Last Outgoing Number	This field displays the last number the SIP account called. It displays **N/A** if the SIP account has never dialed a number.
Call Statistics	
Phone	This field displays the WiMAX Modem's phone port number.
Hook	This field indicates whether the phone is on the hook or off the hook. **On** - The phone is hanging up or already hung up. **Off** - The phone is dialing, calling, or connected.
Status	This field displays the current state of the phone call. **N/A** - There are no current VoIP calls, incoming calls or outgoing calls being made. **DIAL** - The callee's phone is ringing. **RING** - The phone is ringing for an incoming VoIP call. **Process** - There is a VoIP call in progress. **DISC** - The callee's line is busy, the callee hung up or your phone was left off the hook.
Codec	This field displays what voice codec is being used for a current VoIP call through a phone port.
Peer Number	This field displays the SIP number of the party that is currently engaged in a VoIP call through a phone port.
Duration	This field displays how long the current call has lasted.
Tx Pkts	This field displays the number of packets the WiMAX Modem has transmitted in the current call.
Rx Pkts	This field displays the number of packets the WiMAX Modem has received in the current call.
Tx B/s	This field displays how quickly the WiMAX Modem has transmitted packets in the current call. The rate is the average number of bytes transmitted per second.
Rx B/s	This field displays how quickly the WiMAX Modem has received packets in the current call. The rate is the average number of bytes transmitted per second.
Poll Interval(s)	Enter how often you want the WiMAX Modem to update this screen, and click **Set Interval**.
Set Interval	Click this to make the WiMAX Modem update the screen based on the amount of time you specified in **Poll Interval**.
Stop	Click this to make the WiMAX Modem stop updating the screen.

21.2.5 WiMAX Profile

Click **Status > WiMAX Profile** to open this screen. This read-only screen displays information about the security settings you are using. To configure these settings, go to the **ADVANCED > WAN Configuration > Internet Connection** screen.

Note: Not all WiMAX Modem models have all the fields shown here.

Figure 106 WiMAX Profile



The following table describes the labels in this screen.

Table 108 The WiMAX Profile Screen

LABEL	DESCRIPTION
User Name	This is the username for your Internet access account.
Password	This is the password for your Internet access account. The password displays as a row of asterisks for security purposes.
Anonymous Identity	This is the anonymous identity provided by your Internet Service Provider. Anonymous identity (also known as outer identity) is used with EAP-TTLS encryption.
PKM	This field displays the Privacy Key Management version number. PKM provides security between the WiMAX Modem and the base station. See the WiMAX security appendix for more information.
Authentication	This field displays the user authentication method. Authentication is the process of confirming the identity of a user (by means of a username and password, for example). EAP-TTLS allows an MS/SS and a base station to establish a secure link (or 'tunnel') with an AAA (Authentication, Authorization and Accounting) server in order to exchange authentication information. See the WiMAX security appendix for more details.

Table 108 The WiMAX Profile Screen (continued)

LABEL	DESCRIPTION
TTLS Inner EAP	This field displays the type of secondary authentication method. Once a secure EAP-TTLS connection is established, the inner EAP is the protocol used to exchange security information between the mobile station, the base station and the AAA server to authenticate the mobile station. See the WiMAX security appendix for more details. The WiMAX Modem supports the following inner authentication types: • **CHAP** (Challenge Handshake Authentication Protocol) • **MSCHAP** (Microsoft CHAP) • **MSCHAPV2** (Microsoft CHAP version 2) • **PAP** (Password Authentication Protocol)
Certificate	This is the security certificate the WiMAX Modem uses to authenticate the AAA server, if one is available.

PART VI
Troubleshooting and Specifications

Troubleshooting (249)

Product Specifications (257)

22

Troubleshooting

This chapter offers some suggestions to solve problems you might encounter. The potential problems are divided into the following categories:

- Power, Hardware Connections, and LEDs
- WiMAX Modem Access and Login
- Internet Access
- Phone Calls and VoIP
- Reset the WiMAX Modem to Its Factory Defaults

22.1 Power, Hardware Connections, and LEDs

The WiMAX Modem does not turn on. None of the LEDs turn on.

1. Make sure you are using the power adapter or cord included with the WiMAX Modem.
2. Make sure the power adapter or cord is connected to the WiMAX Modem and plugged in to an appropriate power source. Make sure the power source is turned on.
3. Disconnect and re-connect the power adapter or cord to the WiMAX Modem.
4. If the problem continues, contact the vendor.

One of the LEDs does not behave as expected.

1. Make sure you understand the normal behavior of the LED. See Section 1.2.1 on page 33 for more information.

2 Check the hardware connections. See the Quick Start Guide.

3 Inspect your cables for damage. Contact the vendor to replace any damaged cables.

4 Disconnect and re-connect the power adapter to the WiMAX Modem.

5 If the problem continues, contact the vendor.

22.2 WiMAX Modem Access and Login

I forgot the IP address for the WiMAX Modem.

1 The default IP address is http://192.168.1.1.

2 If you changed the IP address and have forgotten it, you might get the IP address of the WiMAX Modem by looking up the IP address of the default gateway for your computer. To do this in most Windows computers, click **Start > Run**, enter **cmd**, and then enter **ipconfig**. The IP address of the **Default Gateway** might be the IP address of the WiMAX Modem (it depends on the network), so enter this IP address in your Internet browser.

3 If this does not work, you have to reset the WiMAX Modem to its factory defaults. See Section 22.1 on page 249.

I forgot the password.

1 The default password is **1234**.

2 If this does not work, you have to reset the WiMAX Modem to its factory defaults. See Section 11.5 on page 126.

I cannot see or access the **Login** screen in the web configurator.

1 Make sure you are using the correct IP address.

- The default IP address is http://192.168.1.1.

- If you changed the IP address (Section 6.2 on page 66), use the new IP address.
- If you changed the IP address and have forgotten it, see the troubleshooting suggestions for I forgot the IP address for the WiMAX Modem.

2 Check the hardware connections, and make sure the LEDs are behaving as expected. See the Quick Start Guide and Section 1.2.1 on page 33.

3 Make sure your Internet browser does not block pop-up windows and has JavaScript and Java enabled. See Appendix C on page 299.

4 If there is a DHCP server on your network, make sure your computer is using a dynamic IP address. Your WiMAX Modem is a DHCP server by default.

If there is no DHCP server on your network, make sure your computer's IP address is in the same subnet as the WiMAX Modem. See Appendix D on page 309.

5 Reset the WiMAX Modem to its factory defaults, and try to access the WiMAX Modem with the default IP address. See Section 11.6 on page 127.

6 If the problem continues, contact the network administrator or vendor, or try one of the advanced suggestions.

Advanced Suggestions

- Try to access the WiMAX Modem using another service, such as Telnet. If you can access the WiMAX Modem, check the remote management settings and firewall rules to find out why the WiMAX Modem does not respond to HTTP.
- If your computer is connected wirelessly, use a computer that is connected to a **LAN**/**ETHERNET** port.

I can see the **Login** screen, but I cannot log in to the WiMAX Modem.

1 Make sure you have entered the user name and password correctly. The default user name is **user**, and the default password is **1234**. These fields are case-sensitive, so make sure [Caps Lock] is not on.

2 You cannot log in to the web configurator while someone is using Telnet to access the WiMAX Modem. Log out of the WiMAX Modem in the other session, or ask the person who is logged in to log out.

3 Disconnect and re-connect the power adapter or cord to the WiMAX Modem.

4 If this does not work, you have to reset the WiMAX Modem to its factory defaults. See Section 11.5 on page 126.

I cannot Telnet to the WiMAX Modem.

See the troubleshooting suggestions for I cannot see or access the Login screen in the web configurator. Ignore the suggestions about your browser.

22.3 Internet Access

I cannot access the Internet.

1. Check the hardware connections, and make sure the LEDs are behaving as expected. See the Quick Start Guide and Section 1.2.1 on page 33.
2. Make sure you entered your ISP account information correctly in the wizard. These fields are case-sensitive, so make sure [Caps Lock] is not on.
3. Check your security settings. In the web configurator, go to the **Status** screen. Click the **WiMAX Profile** link in the **Summary** box and make sure that you are using the correct security settings for your Internet account.
4. Check your WiMAX settings. The WiMAX Modem may have been set to search the wrong frequencies for a wireless connection. In the web configurator, go to the **Status** screen. Click the **WiMAX Site Information** link in the **Summary** box and ensure that the values are correct. If the values are incorrect, enter the correct frequency settings in the **ADVANCED > WAN Configuration > WiMAX Configuration** screen. If you are unsure of the correct values, contact your service provider.
5. If you are trying to access the Internet wirelessly, make sure the wireless settings in the wireless client are the same as the settings in the AP.
6. Disconnect all the cables from your WiMAX Modem, and follow the directions in the Quick Start Guide again.
7. If the problem continues, contact your ISP.

I cannot access the Internet any more. I had access to the Internet (with the WiMAX Modem), but my Internet connection is not available any more.

1. Check the hardware connections, and make sure the LEDs are behaving as expected. See the Quick Start Guide and Section 1.2.1 on page 33.
2. Disconnect and re-connect the power adapter to the WiMAX Modem.
3. If the problem continues, contact your ISP.

The Internet connection is slow or intermittent.

1. The quality of the WiMAX Modem's wireless connection to the base station may be poor. Poor signal reception may be improved by moving the WiMAX Modem away from thick walls and other obstructions, or to a higher floor in your building.
2. There may be radio interference caused by nearby electrical devices such as microwave ovens and radio transmitters. Move the WiMAX Modem away or switch the other devices off. Weather conditions may also affect signal quality.
3. There might be a lot of traffic on the network. Look at the LEDs, and check Section 1.2.1 on page 33. If the WiMAX Modem is sending or receiving a lot of information, try closing some programs that use the Internet, especially peer-to-peer applications.
4. Disconnect and re-connect the power adapter to the WiMAX Modem.
5. If the problem continues, contact the network administrator or vendor, or try one of the advanced suggestions.

The Internet connection disconnects.

1. Check your WiMAX link and signal strength using the **WiMAX Link** and **Strength Indicator** LEDs on the device.
2. Contact your ISP if the problem persists.

22.4 Phone Calls and VoIP

The telephone port won't work or the telephone lacks a dial tone.

1. Check the telephone connections and telephone wire.
2. Make sure you have the **VOICE > Service Configuration > SIP Settings** screen properly configured (Chapter 12 on page 131).

I can access the Internet, but cannot make VoIP calls.

1. Make sure you have the **VOICE > Service Configuration > SIP Settings** screen properly configured (Chapter 12 on page 131).
2. The **VoIP** LED should come on. Make sure that your telephone is connected to the **VoIP** port (see the Quick Start Guide for information on connecting telephone cables to the these ports).
3. You can also check the VoIP status in the **Status** screen.
4. If the VoIP settings are correct, use speed dial to make peer-to-peer calls. If you cannot make a call using speed dial, there may be something wrong with the SIP server. Contact your VoIP service provider.

Problems With Multiple SIP Accounts

You can set up two SIP accounts on your WiMAX Modem. By default your WiMAX Modem uses SIP account 1 for outgoing calls, and it uses SIP accounts 1 and 2 for incoming calls. With this setting, you always use SIP account 1 for your outgoing calls and you cannot distinguish which SIP account the calls are coming in through. If you want to control the use of different dialing plans for accounting purposes or other reasons, you need to configure your phone port in order to control which SIP account you are using when placing or receiving calls.

22.5 Reset the WiMAX Modem to Its Factory Defaults

If you reset the WiMAX Modem, you lose all of the changes you have made. The WiMAX Modem re-loads its default settings, and the password resets to **1234**. You have to make all of your changes again.

You will lose all of your changes when you push the **Reset** button.

To reset the WiMAX Modem,

1. Make sure the **Power LED** is on and not blinking.
2. Press and hold the **Reset** button for five to ten seconds. Release the **Reset** button when the **Power** LED begins to blink. The default settings have been restored.

   If the WiMAX Modem restarts automatically, wait for the WiMAX Modem to finish restarting, and log in to the web configurator. The password is “1234”.

   If the WiMAX Modem does not restart automatically, disconnect and reconnect the WiMAX Modem’s power. Then, follow the directions above again.

22.5.1 Pop-up Windows, JavaScripts and Java Permissions

Please see Appendix C on page 299.

23

Product Specifications

This chapter gives details about your WiMAX Modem's hardware and firmware features.

Table 109 Environmental and Hardware Specifications

FEATURE	DESCRIPTION
Operating Temperature	-40°C to 60°C (ODU), -5°C to 55°C (IDU)
Storage Temperature	-40°C to 65°C (ODU), -25°C to 60°C (IDU)
Operating Humidity	10% ~ 90% (non-condensing)
Storage Humidity	10% to 95% (non-condensing)
Power Supply	Input: 90V-270V, 50/60Hz Output: 48.0V --- 0.38A
Power Consumption	MAX-306M1: US: maximum 9.61W, EU: maximum 7.77W MAX-306M1: US: maximum 10.46W, EU: maximum 9.00W
Ethernet Interface	One auto-negotiating, auto-MDI/MDI-X NWay 10/100 Mbps RJ-45 Ethernet port
Telephony Interface	One analog ATA interfaces for standard telephones through RJ-11 FXS (Foreign Exchange Subscriber) analog connector
Power over Ethernet Interface (PoE)	One RJ-45-type PoE port providing 48V DC to the MAX-306M1-ODU from the MAX-306M1-IDU
Antennas	One 15dBi ± 0.5dBi Cross-Polarization antenna (ODU)
Weight	400g
Dimensions	ODU: 372 (L) mm x 232 (W) mm x 54.8 (H) mm IDU: 124.5 (L) mm x 97.2 (W) mm x 40.2 (H) mm
EMC Approvals	FCC Part 15B
RF Approvals	FCC Part 27

Table 110 Radio Specifications

FEATURE	DESCRIPTION
WiMAX Operating Frequency	MAX-306M1: 2.5~2.7 GHz MAX-316M1: 3.4~3.6 GHz
Channel Bandwidth	5MHz / 10MHz
Maximum Transmit Power	26dbm with ODU antenna deployed.
WiMAX Compliance	Compliant to receiver performances defined in IEEE P802.16-2005, §8.4.13.

Table 111 Firmware Specifications

FEATURE	DESCRIPTION
Web-based Configuration and Management Tool	Also known as “the web configurator”, this is a firmware-based management solution for the WiMAX Modem. You must connect using a compatible web browser in order to use it.
High Speed Wireless Internet Access	The WiMAX Modem is ideal for high-speed wireless Internet browsing. WiMAX (Worldwide Interoperability for Microwave Access) is a wireless networking standard providing high-bandwidth, wide-range secured wireless service. The WiMAX Modem is a WiMAX mobile station (MS) compatible with the IEEE 802.16e standard.
Firewall	The WiMAX Modem is a stateful inspection firewall with DoS (Denial of Service) protection. By default, when the firewall is activated, all incoming traffic from the WAN to the LAN is blocked unless it is initiated from the LAN. The WiMAX Modem’s firewall supports TCP/UDP inspection, DoS detection and prevention, real time alerts, reports and logs.
Content Filtering	The WiMAX Modem can block access to web sites containing specified keywords. You can define time periods and days during which content filtering is enabled and include or exclude a range of users on the LAN from content filtering.
Network Address Translation (NAT)	Network Address Translation (NAT) allows the translation of an Internet protocol address used within one network (for example a private IP address used in a local network) to a different IP address known within another network (for example a public IP address used on the Internet).
Universal Plug and Play (UPnP)	Your device and other UPnP enabled devices can use the standard TCP/IP protocol to dynamically join a network, obtain an IP address and convey their capabilities to each other.
Dynamic DNS Support	With Dynamic DNS support, you can have a static hostname alias for a dynamic IP address, allowing the host to be more easily accessible from various locations on the Internet. You must register for this service with a Dynamic DNS service provider.

Table 111 Firmware Specifications (continued)

FEATURE	DESCRIPTION
DHCP	DHCP (Dynamic Host Configuration Protocol) allows the individual clients (computers) to obtain the TCP/IP configuration at start-up from a centralized DHCP server. Your device has built-in DHCP server capability enabled by default. It can assign IP addresses, an IP default gateway and DNS servers to DHCP clients. Your device can also act as a surrogate DHCP server (DHCP Relay) where it relays IP address assignment from the actual real DHCP server to the clients.
IP Alias	IP alias allows you to partition a physical network into logical networks over the same Ethernet interface. Your device supports three logical LAN interfaces via its single physical Ethernet interface with the your device itself as the gateway for each LAN network.
Multiple SIP Accounts	You can configure multiple voice (SIP) accounts.
SIP ALG	Your device is a SIP Application Layer Gateway (ALG). It allows VoIP calls to pass through NAT for devices behind it (such as a SIP-based VoIP software application on a computer).
Dynamic Jitter Buffer	The built-in adaptive buffer helps to smooth out the variations in delay (jitter) for voice traffic (up to 60 ms). This helps ensure good voice quality for your conversations.
Voice Activity Detection/ Silence Suppression	Voice Activity Detection (VAD) reduces the bandwidth that a call uses by not transmitting when you are not speaking.
Comfort Noise Generation	Your device generates background noise to fill moments of silence when the other device in a call stops transmitting because the other party is not speaking (as total silence could easily be mistaken for a lost connection).
Echo Cancellation	You device supports G.168 of at least 24 ms. This an ITU-T standard for eliminating the echo caused by the sound of your voice reverberating in the telephone receiver while you talk.
Time and Date	Get the current time and date from an external server when you turn on your WiMAX Modem. You can also set the time manually.
Logging	Use the WiMAX Modem's logging feature to view connection history, surveillance logs, and error messages.
Codecs	Enhanced Variable Rate Codec (EVRC), G.711 (PCM µ-law and a-law), G.729a, and G.723.1
Fax Support	T.38 FAX relay (FAX over UDP). G.711 fax relay for fax calls and be able to renegotiate codec to G.711 if a fax call is detected.
Ring Tones	Supports different distinctive ring tones on each line.
Call Prioritization	Prioritize VoIP traffic originating from the RJ-11 ports over any other traffic.

Table 112 Standards Supported

STANDARD	DESCRIPTION
RFC 768	User Datagram Protocol
RFC 791	Internet Protocol v4
RFC 792	Internet Control Message Protocol
RFC 792	Transmission Control Protocol
RFC 826	Address Resolution Protocol
RFC 854	Telnet Protocol
RFC 1349	Type of Service Protocol
RFC 1706	DNS NSAP Resource Records
RFC 1889	Real-time Transport Protocol (RTP)
RFC 1890	Real-time Transport Control Protocol (RTCP)
RFC 2030	Simple Network Time Protocol
RFC 2104	HMAC: Keyed-Hashing for Message Authentication
RFC 2131	Dynamic Host Configuration Protocol
RFC 2401	Security Architecture for the Internet Protocol
RFC 2409	Internet Key Exchange
RFC 2475	Architecture for Differentiated Services (Diffserv)
RFC 2617	Hypertext Transfer Protocol (HTTP) Authentication: Basic and Digest Access Authentication
RFC 2782	A DNS RR for specifying the location of services (DNS SRV)
RFC 2833	Real-time Transport Protocol Payload for DTMF Digits, Telephony Tones and Telephony Signals
RFC 2976	The SIP INFO Method
RFC 3261	Session Initiation Protocol (SIP version 2)
RFC 3262	Reliability of Provisional Responses in the Session Initiation Protocol (SIP).
RFC 3263	Session Initiation Protocol (SIP): Locating SIP Servers
RFC 3264	An Offer/Answer Model with the Session Description Protocol (SDP)
RFC 3265	Session Initiation Protocol (SIP)-Specific Event Notification
RFC 3323	A Privacy Mechanism for SIP
RFC 3325	Private Extensions to the Session Initiation Protocol (SIP) for Asserted Identity within Trusted Networks
RFC 3550	RTP - A Real Time Protocol for Real-Time Applications
RFC 3581	An Extension to the Session Initiation Protocol (SIP) for Symmetric Response Routing
RFC 3611	RTP Control Protocol Extended Reports (RTCP XR)-XR
RFC 3715	IP Sec/NAT Compatibility
RFC 3842	A Message Summary and Message Waiting Indication Event Package for the Session Initiation Protocol (SIP)

Table 112 Standards Supported (continued)

STANDARD	DESCRIPTION
IEEE 802.3	10BASE5 10 Mbit/s (1.25 MB/s)
IEEE 802.3u	100BASE-TX, 100BASE-T4, 100BASE-FX Fast Ethernet at 100 Mbit/s (12.5 MB/s) with auto-negotiation

Table 113 Voice Features

Call Park and Pickup	Call park and pickup lets you put a call on hold (park) and then continue the call (pickup). The caller must still pay while the call is parked. When you park the call, you enter a number of your choice (up to eight digits), which you must enter again when you pick up the call. If you do not enter the correct number, you cannot pickup the call. This means that only someone who knows the number you have chosen can pick up the call. You can have more than one call on hold at the same time, but you must give each call a different number.
Call Return	With call return, you can place a call to the last number that called you (either answered or missed). The last incoming call can be through either SIP or PSTN.
Country Code	Phone standards and settings differ from one country to another, so the settings on your WiMAX Modem must be configured to match those of the country you are in. The country code feature allows you to do this by selecting the country from a list rather than changing each setting manually. Configure the country code feature when you move the WiMAX Modem from one country to another.
Do not Disturb (DnD)	This feature allows you to set your phone not to ring when someone calls you. You can set each phone independently using its keypad, or configure global settings for all phones using the command line interpreter.
Auto Dial	You can set the WiMAX Modem to automatically dial a specified number immediately whenever you lift a phone off the hook. Use the Web Configurator to set the specified number. Use the command line interpreter to have the WiMAX Modem wait a specified length of time before dialing the number.
Phone config	The phone configuration table allows you to customize the phone keypad combinations you use to access certain features on the WiMAX Modem, such as call waiting, call return, call forward, etc. The phone configuration table is configurable in command interpreter mode.
Firmware update enable / disable	If your service provider uses this feature, you hear a recorded message when you pick up the phone when new firmware is available for your WiMAX Modem. Enter *99# in your phone's keypad to have the WiMAX Modem upgrade the firmware, or enter #99# to not upgrade. If your service provider gave you different numbers to use, enter them instead. If you enter the code to not upgrade, you can make a call as normal. You will hear the recording again each time you pick up the phone, until you upgrade.

Table 113 Voice Features

Call waiting	This feature allows you to hear an alert when you are already using the phone and another person calls you. You can then either reject the new incoming call, put your current call on hold and receive the new incoming call, or end the current call and receive the new incoming call.
Call forwarding	With this feature, you can set the WiMAX Modem to forward calls to a specified number, either unconditionally (always), when your number is busy, or when you do not answer. You can also forward incoming calls from one specified number to another.
Caller ID	The WiMAX Modem supports caller ID, which allows you to see the originating number of an incoming call (on a phone with a suitable display).
REN	A Ringer Equivalence Number (REN) is used to determine the number of devices (like telephones or fax machines) that may be connected to the telephone line. Your device has a REN of three, so it can support three devices per telephone port.
QoS (Quality of Service)	Quality of Service (QoS) mechanisms help to provide better service on a per-flow basis. Your device supports Type of Service (ToS) tagging and Differentiated Services (DiffServ) tagging. This allows the device to tag voice frames so they can be prioritized over the network.
SIP ALG	Your device is a SIP Application Layer Gateway (ALG). It allows VoIP calls to pass through NAT for devices behind it (such as a SIP-based VoIP software application on a computer).
Other Voice Features	SIP version 2 (Session Initiating Protocol RFC 3261) SDP (Session Description Protocol RFC 2327) RTP (RFC 1889) RTCP (RFC 1890) Voice codecs (coder/decoders) G.711, G.726, G.729 Fax and data modem discrimination DTMF Detection and Generation DTMF: In-band and Out-band traffic (RFC 2833),(PCM), (SIP INFO) Point-to-point call establishment between two IADs Quick dialing through predefined phone book, which maps the phone dialing number and destination URL. Flexible Dial Plan (RFC3525 section 7.1.14)

Table 114 Star (*) and Pound (#) Code Support

*0	Wireless Operator Services
*2	Customer Care Access
*66	Repeat Dialing
*67	Plus the 10 digit phone number to block Caller ID on a single call basis
*69	Return last call received

Table 114 Star (*) and Pound (#) Code Support

*70	Followed by the 10 digit phone number to cancel Call Waiting on a single call basis
*72	Activate Call Forwarding (*72 followed by the 10 digit phone number that is requesting call forwarding service)
*720	Activate Call Forwarding (*720 followed by the 10 digit phone number that is requesting deactivation of call forwarding service)
*73	Plus the forward to phone number to activate Call Forwarding No Answer (no VM service plan)
*730	Deactivate Call Forwarding No Answer
*740	Plus the forward to phone number to activate Call Forwarding Busy (no VM service plan)
*911/911	Emergency phone number (same as dialing 911)
*411/411	Wireless Information Services

To take full advantage of the supplementary phone services available through the WiMAX Modem's phone port, you may need to subscribe to the services from your voice account service provider.

Not all features are supported by all service providers. Consult your service provider for more information.

PART VII
Appendices and Index

WiMAX Security (267)

Setting Up Your Computer's IP Address (271)

Pop-up Windows, JavaScripts and Java Permissions (299)

IP Addresses and Subnetting (309)

Importing Certificates (321)

SIP Passthrough (353)

Common Services (355)

Legal Information (359)

Customer Support (363)

A

WiMAX Security

Wireless security is vital to protect your wireless communications. Without it, information transmitted over the wireless network would be accessible to any networking device within range.

User Authentication and Data Encryption

The WiMAX (IEEE 802.16) standard employs user authentication and encryption to ensure secured communication at all times.

User authentication is the process of confirming a user's identity and level of authorization. Data encryption is the process of encoding information so that it cannot be read by anyone who does not know the code.

WiMAX uses PKMv2 (Privacy Key Management version 2) for authentication, and CCMP (Counter Mode with Cipher Block Chaining Message Authentication Protocol) for data encryption.

WiMAX supports EAP (Extensible Authentication Protocol, RFC 2486) which allows additional authentication methods to be deployed with no changes to the base station or the mobile or subscriber stations.

PKMv2

PKMv2 is a procedure that allows authentication of a mobile or subscriber station and negotiation of a public key to encrypt traffic between the MS/SS and the base station. PKMv2 uses standard EAP methods such as Transport Layer Security (EAP-TLS) or Tunneled TLS (EAP-TTLS) for secure communication.

In cryptography, a 'key' is a piece of information, typically a string of random numbers and letters, that can be used to 'lock' (encrypt) or 'unlock' (decrypt) a message. Public key encryption uses key pairs, which consist of a public (freely available) key and a private (secret) key. The public key is used for encryption and the private key is used for decryption. You can decrypt a message only if you have the private key. Public key certificates (or 'digital IDs') allow users to verify each other's identity.

RADIUS

RADIUS is based on a client-server model that supports authentication, authorization and accounting. The base station is the client and the server is the RADIUS server. The RADIUS server handles the following tasks:

- Authentication

  Determines the identity of the users.
- Authorization

  Determines the network services available to authenticated users once they are connected to the network.
- Accounting

  Keeps track of the client's network activity.

RADIUS is a simple package exchange in which your base station acts as a message relay between the MS/SS and the network RADIUS server.

Types of RADIUS Messages

The following types of RADIUS messages are exchanged between the base station and the RADIUS server for user authentication:

- Access-Request

  Sent by an base station requesting authentication.
- Access-Reject

  Sent by a RADIUS server rejecting access.
- Access-Accept

  Sent by a RADIUS server allowing access.
- Access-Challenge

  Sent by a RADIUS server requesting more information in order to allow access. The base station sends a proper response from the user and then sends another Access-Request message.

The following types of RADIUS messages are exchanged between the base station and the RADIUS server for user accounting:

- Accounting-Request

  Sent by the base station requesting accounting.
- Accounting-Response

  Sent by the RADIUS server to indicate that it has started or stopped accounting.

In order to ensure network security, the access point and the RADIUS server use a shared secret key, which is a password they both know. The key is not sent over

the network. In addition to the shared key, password information exchanged is also encrypted to protect the network from unauthorized access.

Diameter

Diameter (RFC 3588) is a type of AAA server that provides several improvements over RADIUS in efficiency, security, and support for roaming.

Security Association

The set of information about user authentication and data encryption between two computers is known as a security association (SA). In a WiMAX network, the process of security association has three stages.

- Authorization request and reply

  The MS/SS presents its public certificate to the base station. The base station verifies the certificate and sends an authentication key (AK) to the MS/SS.

- Key request and reply

  The MS/SS requests a transport encryption key (TEK) which the base station generates and encrypts using the authentication key.

- Encrypted traffic

  The MS/SS decrypts the TEK (using the authentication key). Both stations can now securely encrypt and decrypt the data flow.

CCMP

All traffic in a WiMAX network is encrypted using CCMP (Counter Mode with Cipher Block Chaining Message Authentication Protocol). CCMP is based on the 128-bit Advanced Encryption Standard (AES) algorithm.

'Counter mode' refers to the encryption of each block of plain text with an arbitrary number, known as the counter. This number changes each time a block of plain text is encrypted. Counter mode avoids the security weakness of repeated identical blocks of encrypted text that makes encrypted data vulnerable to pattern-spotting.

'Cipher Block Chaining Message Authentication' (also known as CBC-MAC) ensures message integrity by encrypting each block of plain text in such a way that its encryption is dependent on the block before it. This series of 'chained' blocks creates a message authentication code (MAC or CMAC) that ensures the encrypted data has not been tampered with.

Authentication

The WiMAX Modem supports EAP-TTLS authentication.

EAP-TTLS (Tunneled Transport Layer Service)

EAP-TTLS is an extension of the EAP-TLS authentication that uses certificates for only the server-side authentications to establish a secure connection (with EAP-TLS digital certifications are needed by both the server and the wireless clients for mutual authentication). Client authentication is then done by sending username and password through the secure connection, thus client identity is protected. For client authentication, EAP-TTLS supports EAP methods and legacy authentication methods such as PAP, CHAP, MS-CHAP and MS-CHAP v2.

B

Setting Up Your Computer's IP Address

Note: Your specific ZyXEL device may not support all of the operating systems described in this appendix. See the product specifications for more information about which operating systems are supported.

This appendix shows you how to configure the IP settings on your computer in order for it to be able to communicate with the other devices on your network. Windows Vista/XP/2000, Mac OS 9/OS X, and all versions of UNIX/LINUX include the software components you need to use TCP/IP on your computer.

If you manually assign IP information instead of using a dynamic IP, make sure that your network's computers have IP addresses that place them in the same subnet.

In this appendix, you can set up an IP address for:

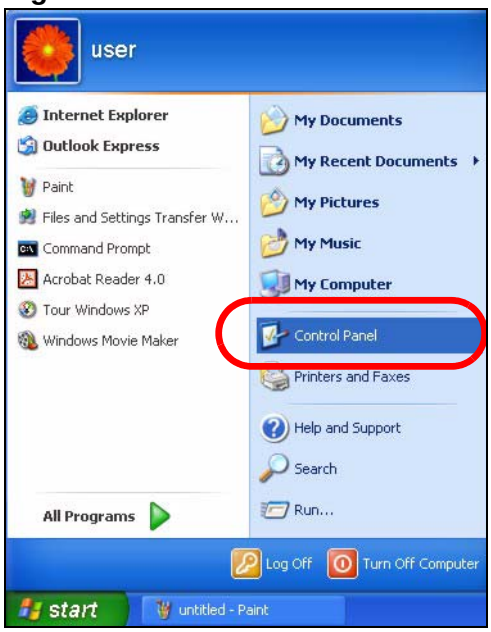
- Windows XP/NT/2000 on page 272
- Windows Vista on page 275
- Mac OS X: 10.3 and 10.4 on page 279
- Mac OS X: 10.5 on page 283
- Linux: Ubuntu 8 (GNOME) on page 286
- Linux: openSUSE 10.3 (KDE) on page 292

Windows XP/NT/2000

The following example uses the default Windows XP display theme but can also apply to Windows 2000 and Windows NT.

1 Click **Start** > **Control Panel**.

Figure 107 Windows XP: Start Menu

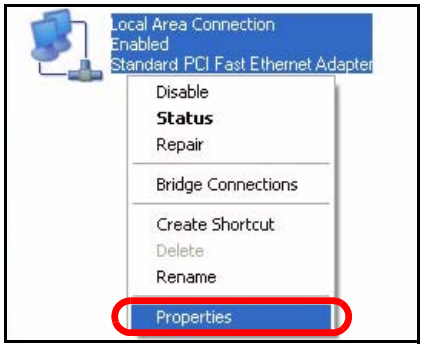


2 In the **Control Panel**, click the **Network Connections** icon.

Figure 108 Windows XP: Control Panel

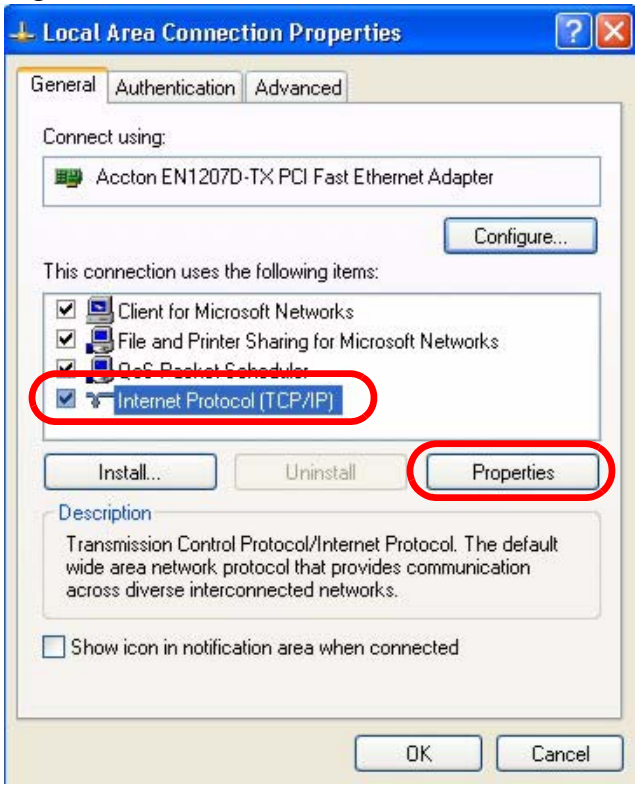
3 Right-click **Local Area Connection** and then select **Properties**.

Figure 109 Windows XP: Control Panel > Network Connections > Properties



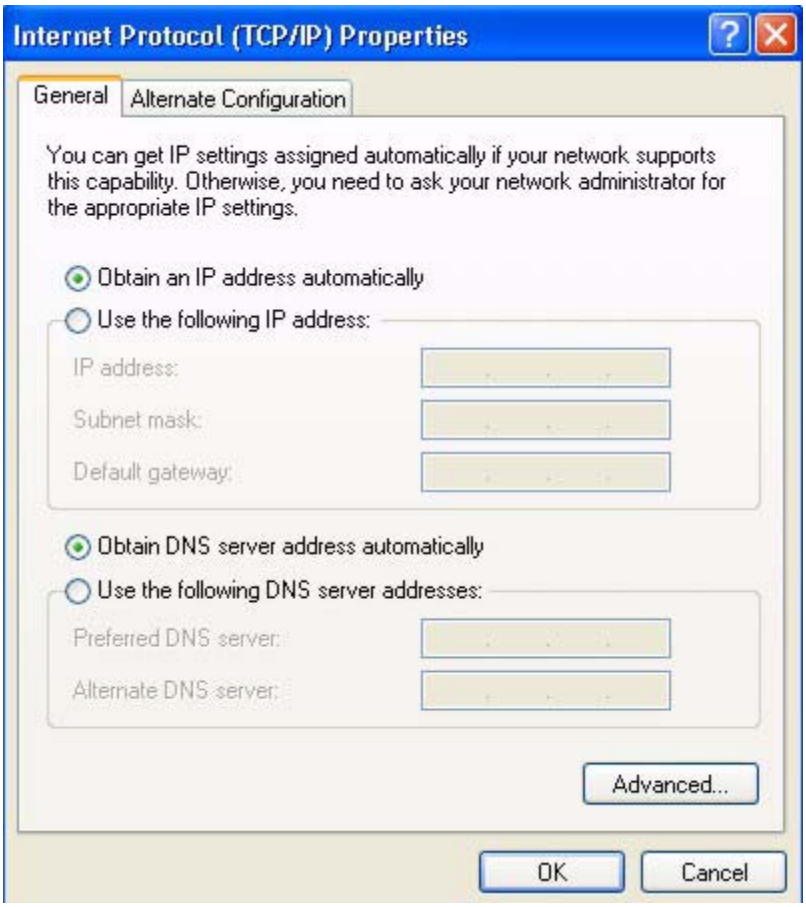
4 On the **General** tab, select **Internet Protocol (TCP/IP)** and then click **Properties**.

Figure 110 Windows XP: Local Area Connection Properties



5 The **Internet Protocol TCP/IP Properties** window opens.

Figure 111 Windows XP: Internet Protocol (TCP/IP) Properties


Internet Protocol (TCP/IP) Properties
General
Alternate Configuration
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
Subnet mask:
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

6 Select **Obtain an IP address automatically** if your network administrator or ISP assigns your IP address dynamically.

Select **Use the following IP Address** and fill in the **IP address**, **Subnet mask**, and **Default gateway** fields if you have a static IP address that was assigned to you by your network administrator or ISP. You may also have to enter a **Preferred DNS server** and an **Alternate DNS server,** if that information was provided.

7 Click **OK** to close the **Internet Protocol (TCP/IP) Properties** window.

Click **OK** to close the **Local Area Connection Properties** window.

Verifying Settings

1 Click **Start** > **All Programs** > **Accessories** > **Command Prompt**.

2 In the **Command Prompt** window, type "ipconfig" and then press [ENTER].

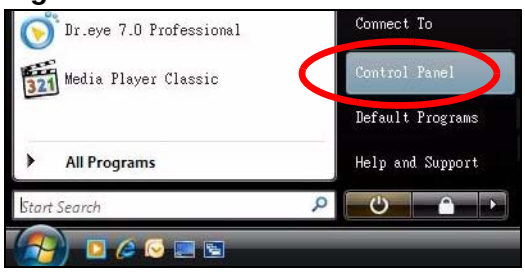
You can also go to **Start > Control Panel > Network Connections**, right-click a network connection, click **Status** and then click the **Support** tab to view your IP address and connection information.

Windows Vista

This section shows screens from Windows Vista Professional.

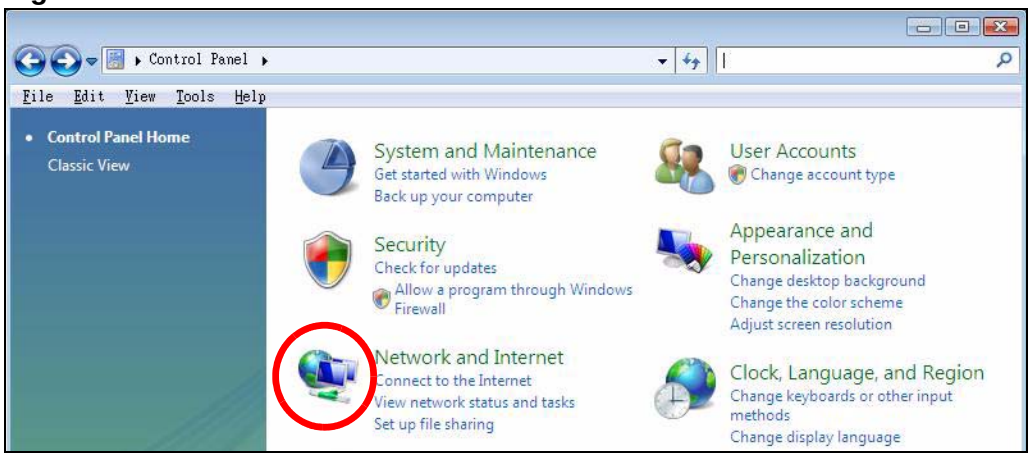
1 Click **Start** > **Control Panel**.

Figure 112 Windows Vista: Start Menu



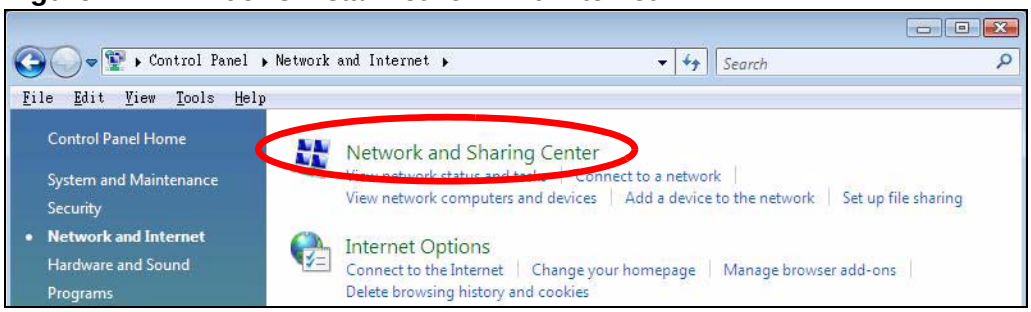
2 In the **Control Panel**, click the **Network and Internet** icon.

Figure 113 Windows Vista: Control Panel



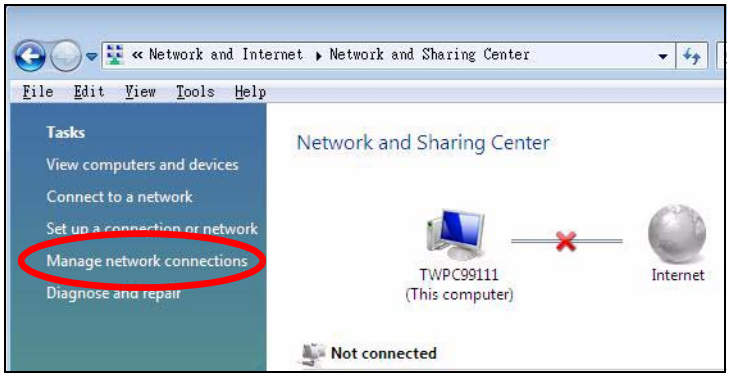
3 Click the **Network and Sharing Center** icon.

Figure 114 Windows Vista: Network And Internet



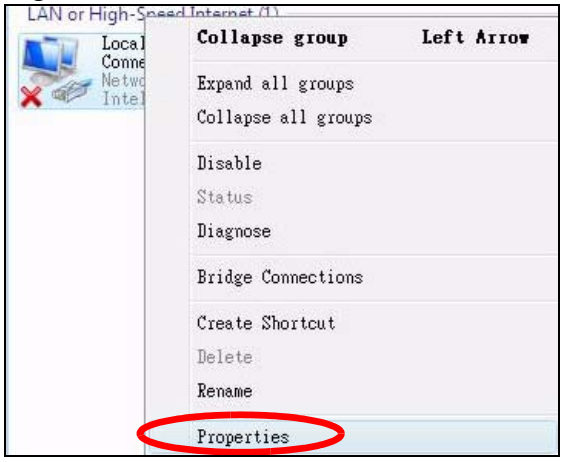
4 Click **Manage network connections**.

Figure 115 Windows Vista: Network and Sharing Center



5 Right-click **Local Area Connection** and then select **Properties**.

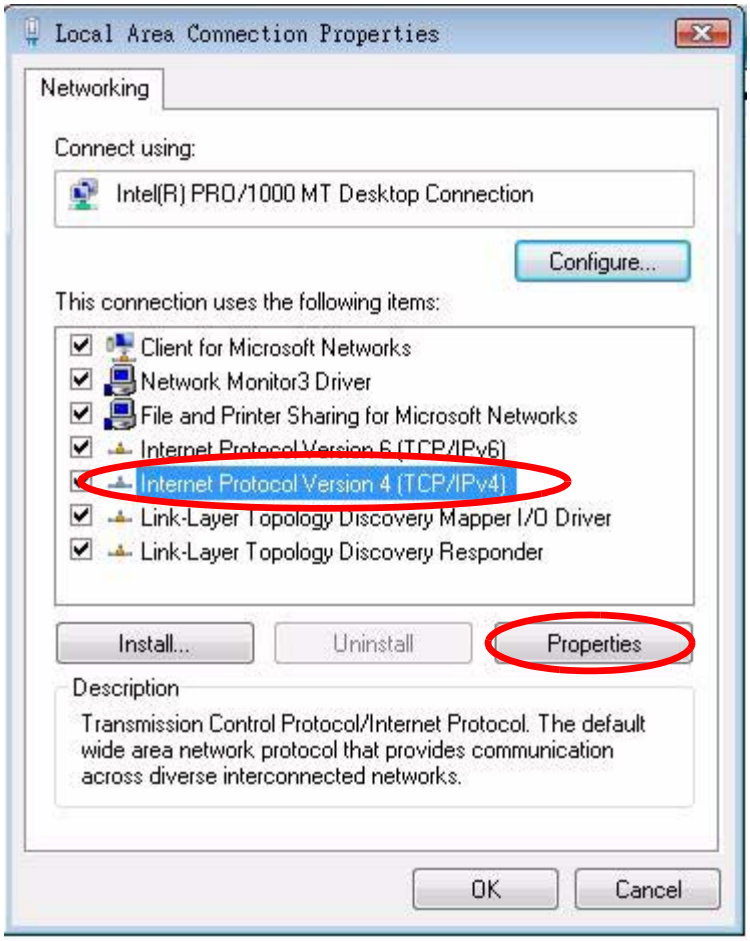
Figure 116 Windows Vista: Network and Sharing Center



Note: During this procedure, click **Continue** whenever Windows displays a screen saying that it needs your permission to continue.

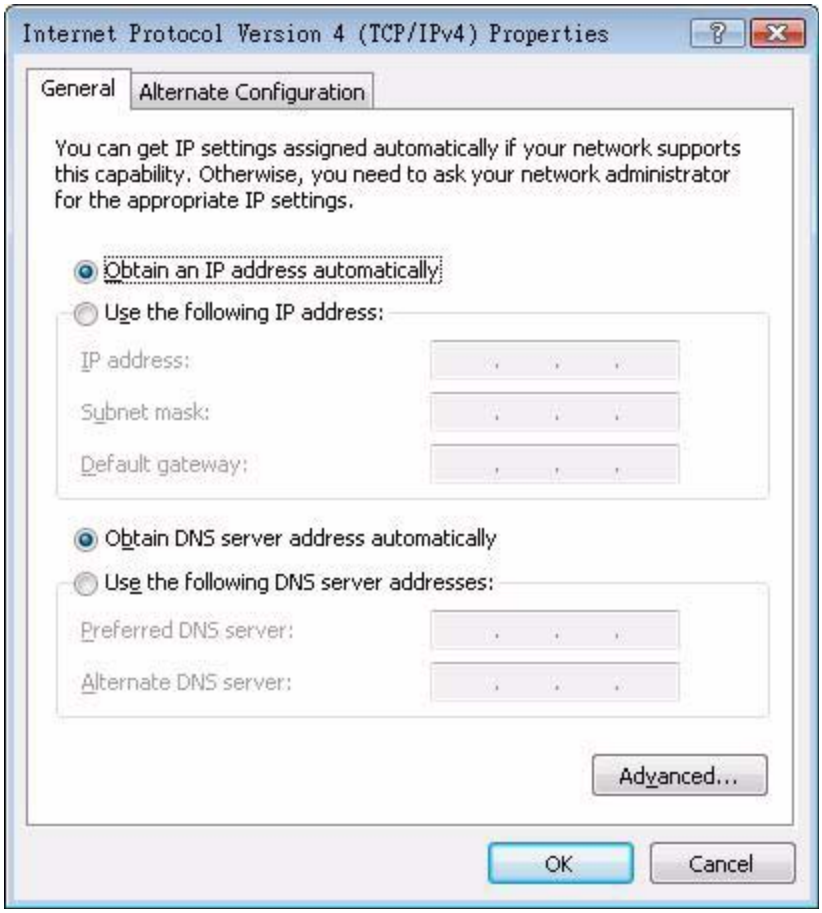
6 Select **Internet Protocol Version 4 (TCP/IPv4)** and then select **Properties**.

Figure 117 Windows Vista: Local Area Connection Properties



7 The **Internet Protocol Version 4 (TCP/IPv4) Properties** window opens.

Figure 118 Windows Vista: Internet Protocol Version 4 (TCP/IPv4) Properties


Internet Protocol Version 4 (TCP/IPv4) Properties
General
Alternate Configuration
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
Subnet mask:
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

8 Select **Obtain an IP address automatically** if your network administrator or ISP assigns your IP address dynamically.

Select **Use the following IP Address** and fill in the **IP address**, **Subnet mask**, and **Default gateway** fields if you have a static IP address that was assigned to you by your network administrator or ISP. You may also have to enter a **Preferred DNS server** and an **Alternate DNS server,** if that information was provided.Click **Advanced**.

9 Click **OK** to close the **Internet Protocol (TCP/IP) Properties** window.

Click **OK** to close the **Local Area Connection Properties** window.

Verifying Settings

1 Click **Start** > **All Programs** > **Accessories** > **Command Prompt**.

2 In the **Command Prompt** window, type "ipconfig" and then press [ENTER].

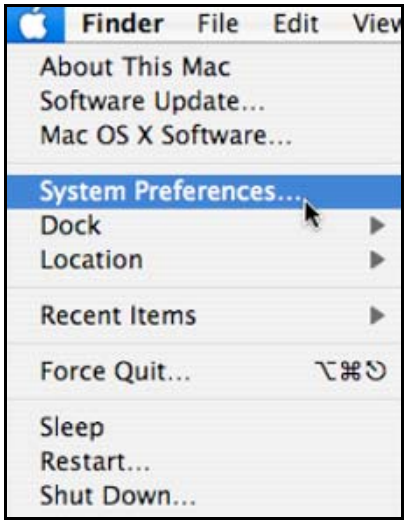
You can also go to **Start > Control Panel > Network Connections**, right-click a network connection, click **Status** and then click the **Support** tab to view your IP address and connection information.

Mac OS X: 10.3 and 10.4

The screens in this section are from Mac OS X 10.4 but can also apply to 10.3.

1 Click **Apple** > **System Preferences**.

Figure 119 Mac OS X 10.4: Apple Menu

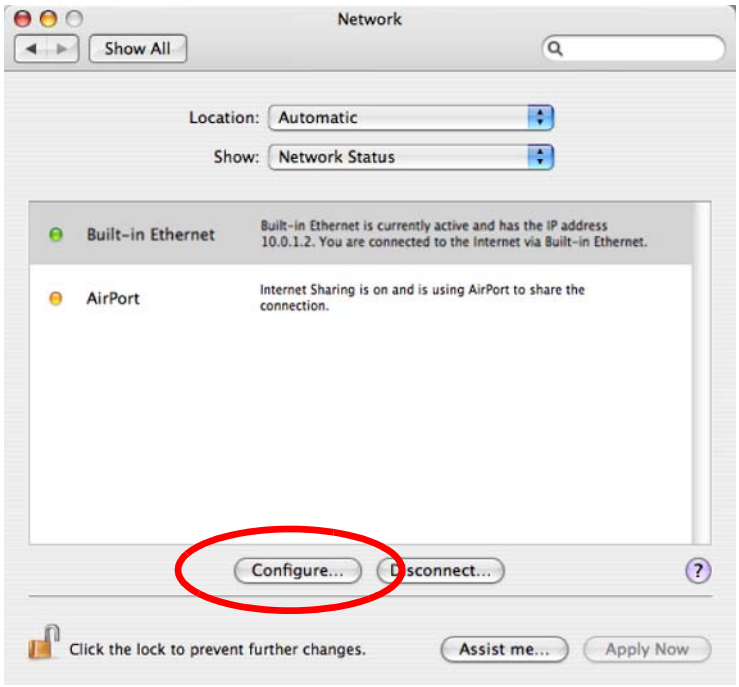


2 In the **System Preferences** window, click the **Network** icon.

Figure 120 Mac OS X 10.4: System Preferences

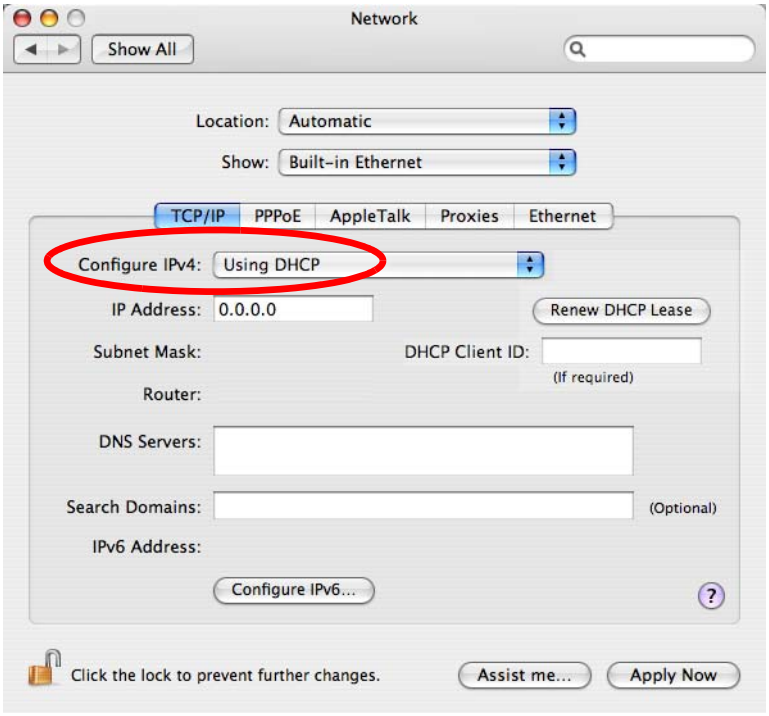
3 When the **Network** preferences pane opens, select **Built-in Ethernet** from the network connection type list, and then click **Configure.**

Figure 121 Mac OS X 10.4: Network Preferences


Network
Show All
Location: Automatic
Show: Network Status
Built-in Ethernet
Built-in Ethernet is currently active and has the IP address 10.0.1.2. You are connected to the Internet via Built-in Ethernet.
AirPort
Internet Sharing is on and is using AirPort to share the connection.
Configure...
Disconnect...
Click the lock to prevent further changes.
Assist me...
Apply Now

4 For dynamically assigned settings, select **Using DHCP** from the **Configure IPv4** list in the **TCP/IP** tab.

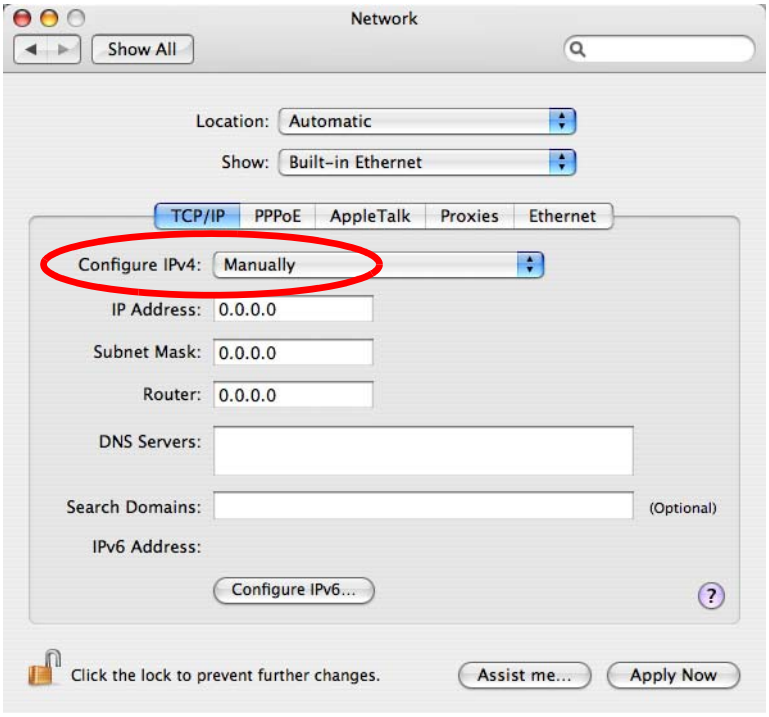
Figure 122 Mac OS X 10.4: Network Preferences > TCP/IP Tab.



5 For statically assigned settings, do the following:

- From the **Configure IPv4** list, select **Manually**.
- In the **IP Address** field, type your IP address.
- In the **Subnet Mask** field, type your subnet mask.
- In the **Router** field, type the IP address of your device.

Figure 123 Mac OS X 10.4: Network Preferences > Ethernet

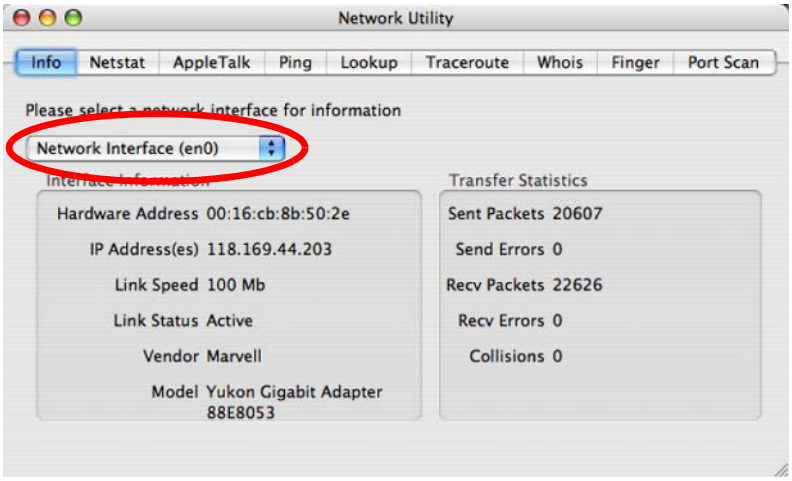


Click **Apply Now** and close the window.

Verifying Settings

Check your TCP/IP properties by clicking **Applications > Utilities > Network Utilities**, and then selecting the appropriate **Network Interface** from the **Info** tab.

Figure 124 Mac OS X 10.4: Network Utility

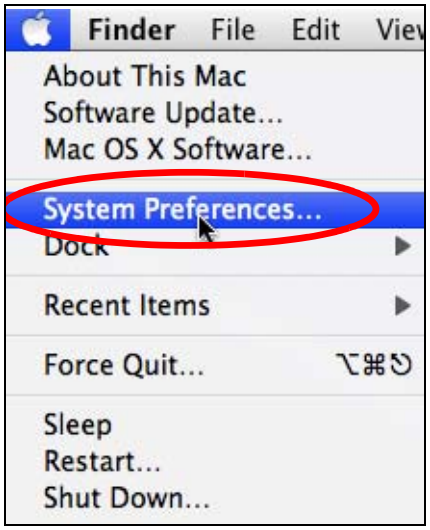


Mac OS X: 10.5

The screens in this section are from Mac OS X 10.5.

1 Click **Apple** > **System Preferences**.

Figure 125 Mac OS X 10.5: Apple Menu

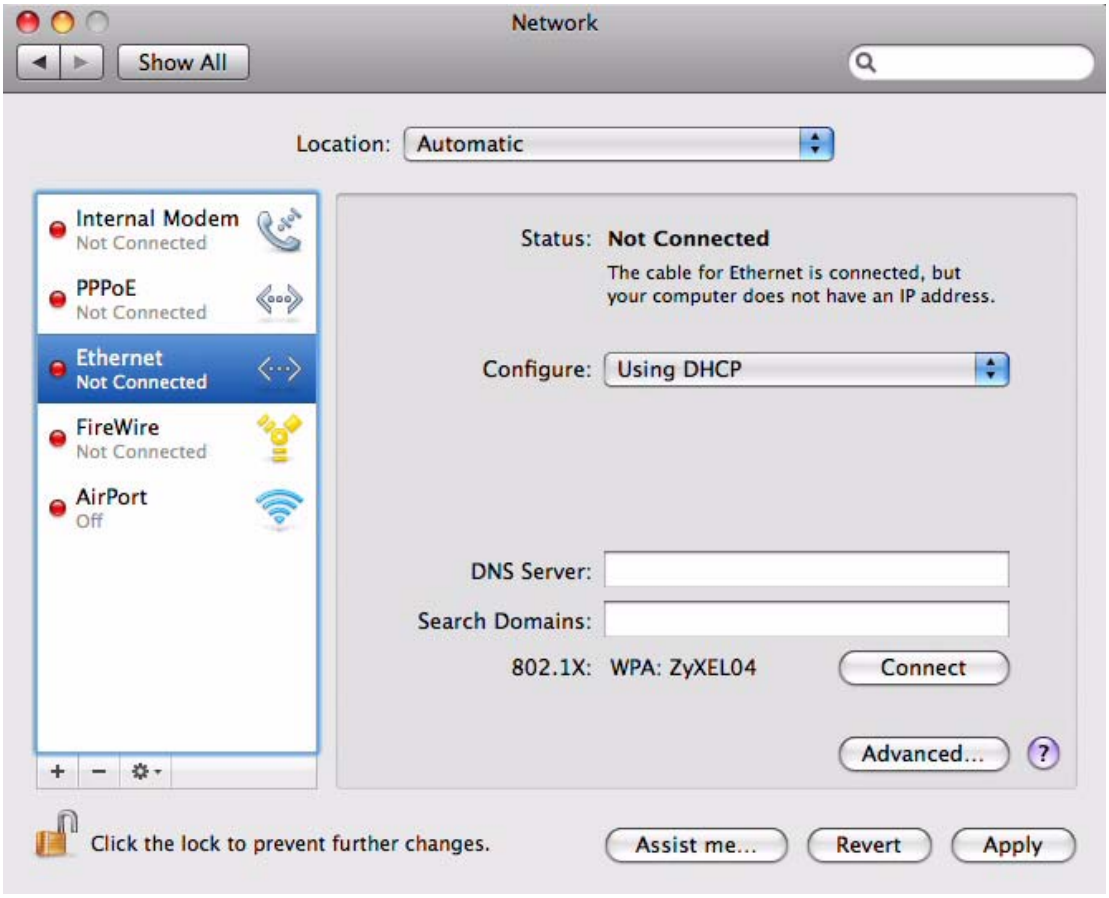


2 In **System Preferences**, click the **Network** icon.

Figure 126 Mac OS X 10.5: Systems Preferences

3 When the **Network** preferences pane opens, select **Ethernet** from the list of available connection types.

Figure 127 Mac OS X 10.5: Network Preferences > Ethernet



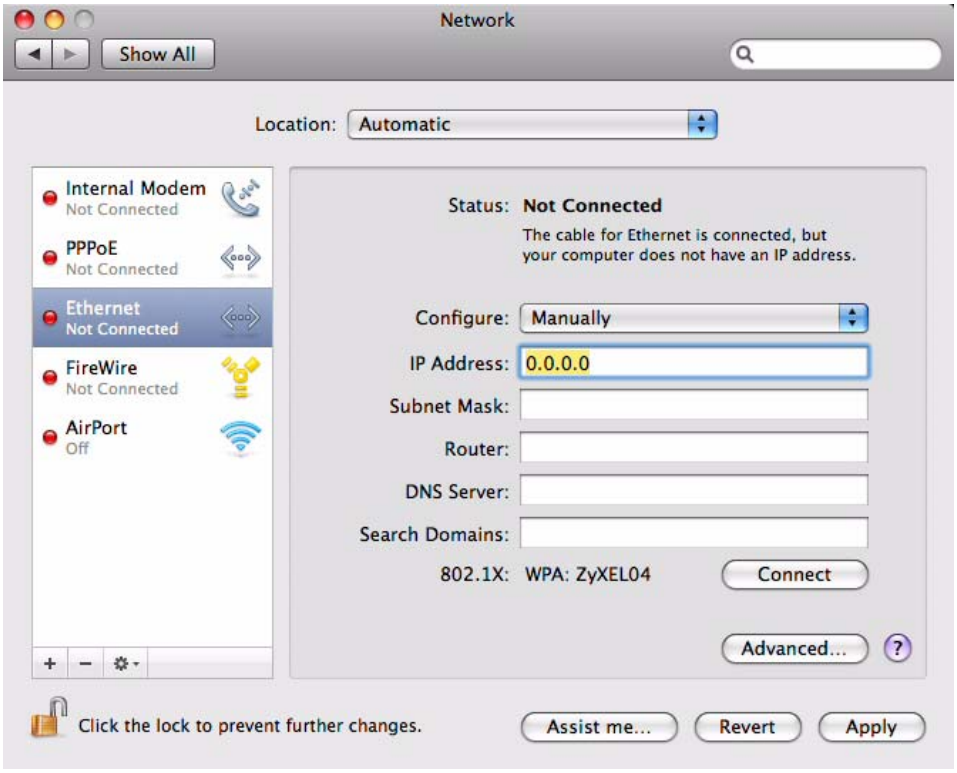
4 From the **Configure** list, select **Using DHCP** for dynamically assigned settings.

5 For statically assigned settings, do the following:

- From the **Configure** list, select **Manually**.
- In the **IP Address** field, enter your IP address.
- In the **Subnet Mask** field, enter your subnet mask.

- In the **Router** field, enter the IP address of your WiMAX Modem.

Figure 128 Mac OS X 10.5: Network Preferences > Ethernet

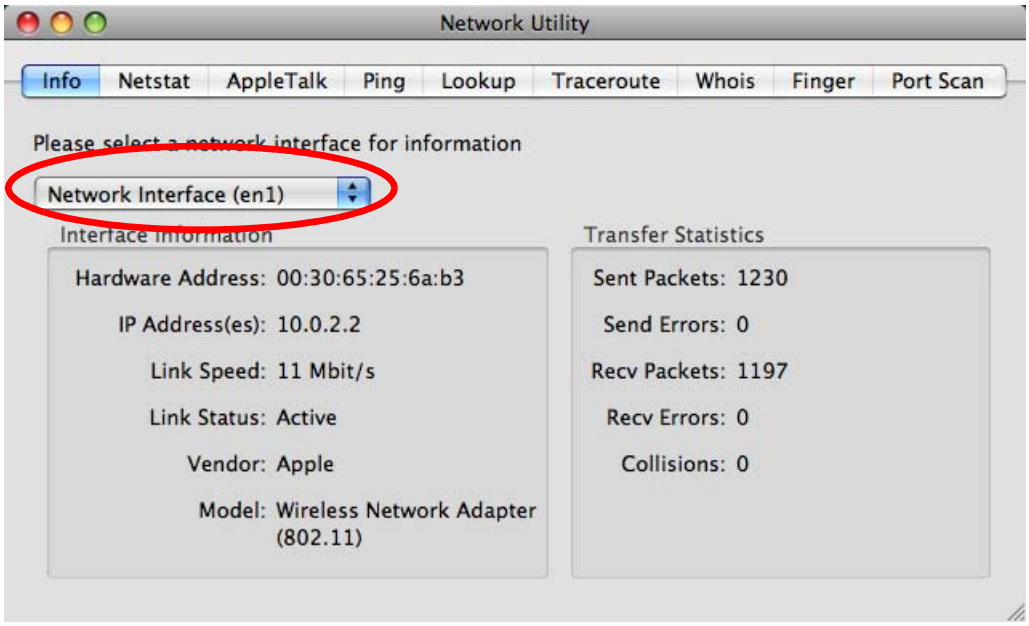


6 Click **Apply** and close the window.

Verifying Settings

Check your TCP/IP properties by clicking **Applications > Utilities > Network Utilities**, and then selecting the appropriate **Network interface** from the **Info** tab.

Figure 129 Mac OS X 10.5: Network Utility



Linux: Ubuntu 8 (GNOME)

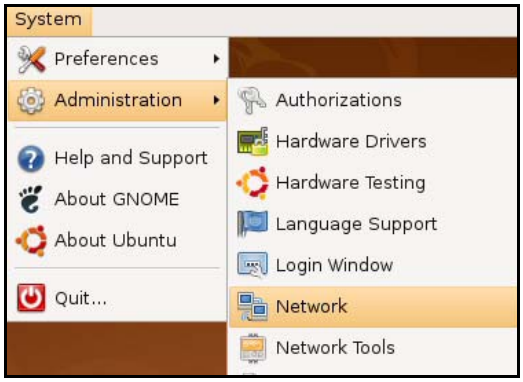
This section shows you how to configure your computer's TCP/IP settings in the GNU Object Model Environment (GNOME) using the Ubuntu 8 Linux distribution. The procedure, screens and file locations may vary depending on your specific distribution, release version, and individual configuration. The following screens use the default Ubuntu 8 installation.

Note: Make sure you are logged in as the root administrator.

Follow the steps below to configure your computer IP address in GNOME:

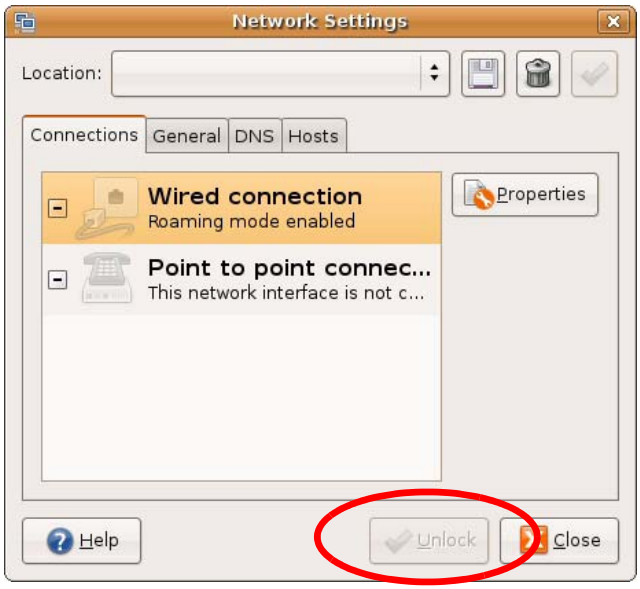
1 Click **System > Administration > Network**.

Figure 130 Ubuntu 8: System > Administration Menu



2 When the **Network Settings** window opens, click **Unlock** to open the **Authenticate** window. (By default, the **Unlock** button is greyed out until clicked.) You cannot make changes to your configuration unless you first enter your admin password.

Figure 131 Ubuntu 8: Network Settings > Connections



3 In the **Authenticate** window, enter your admin account name and password then click the **Authenticate** button.

Figure 132 Ubuntu 8: Administrator Account Authentication

Authenticate
System policy prevents modifying the configuration
An application is attempting to perform an action that requires privileges. Authentication as one of the users below is required to perform this action.
C.J.,,,, (chris)
Password for chris:
Details
Cancel
Authenticate

4 In the **Network Settings** window, select the connection that you want to configure, then click **Properties**.

Figure 133 Ubuntu 8: Network Settings > Connections

5 The **Properties** dialog box opens.

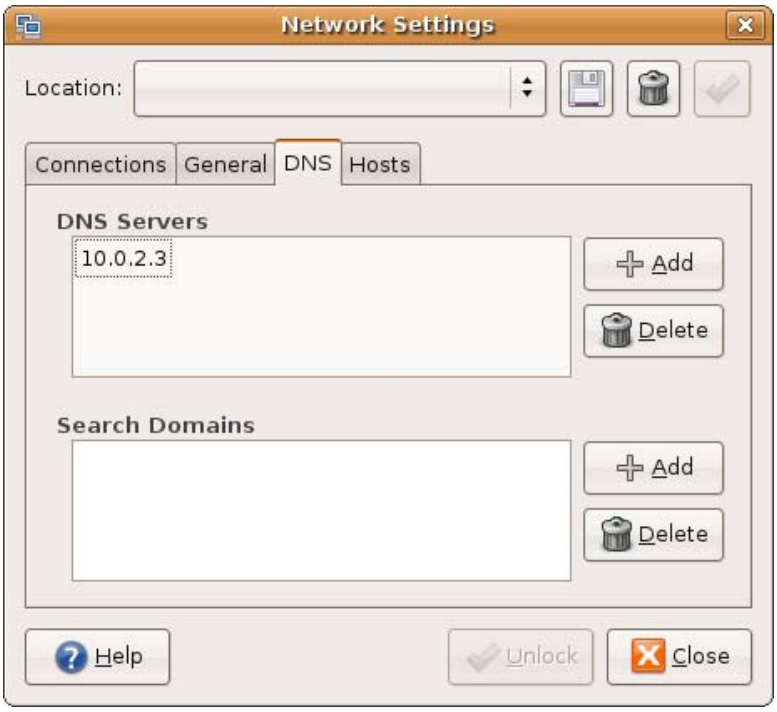
Figure 134 Ubuntu 8: Network Settings > Properties

- In the **Configuration** list, select **Automatic Configuration (DHCP)** if you have a dynamic IP address.
- In the **Configuration** list, select **Static IP address** if you have a static IP address. Fill in the **IP address**, **Subnet mask**, and **Gateway address** fields.

6 Click **OK** to save the changes and close the **Properties** dialog box and return to the **Network Settings** screen.

7 If you know your DNS server IP address(es), click the **DNS** tab in the **Network Settings** window and then enter the DNS server information in the fields provided.

Figure 135 Ubuntu 8: Network Settings > DNS



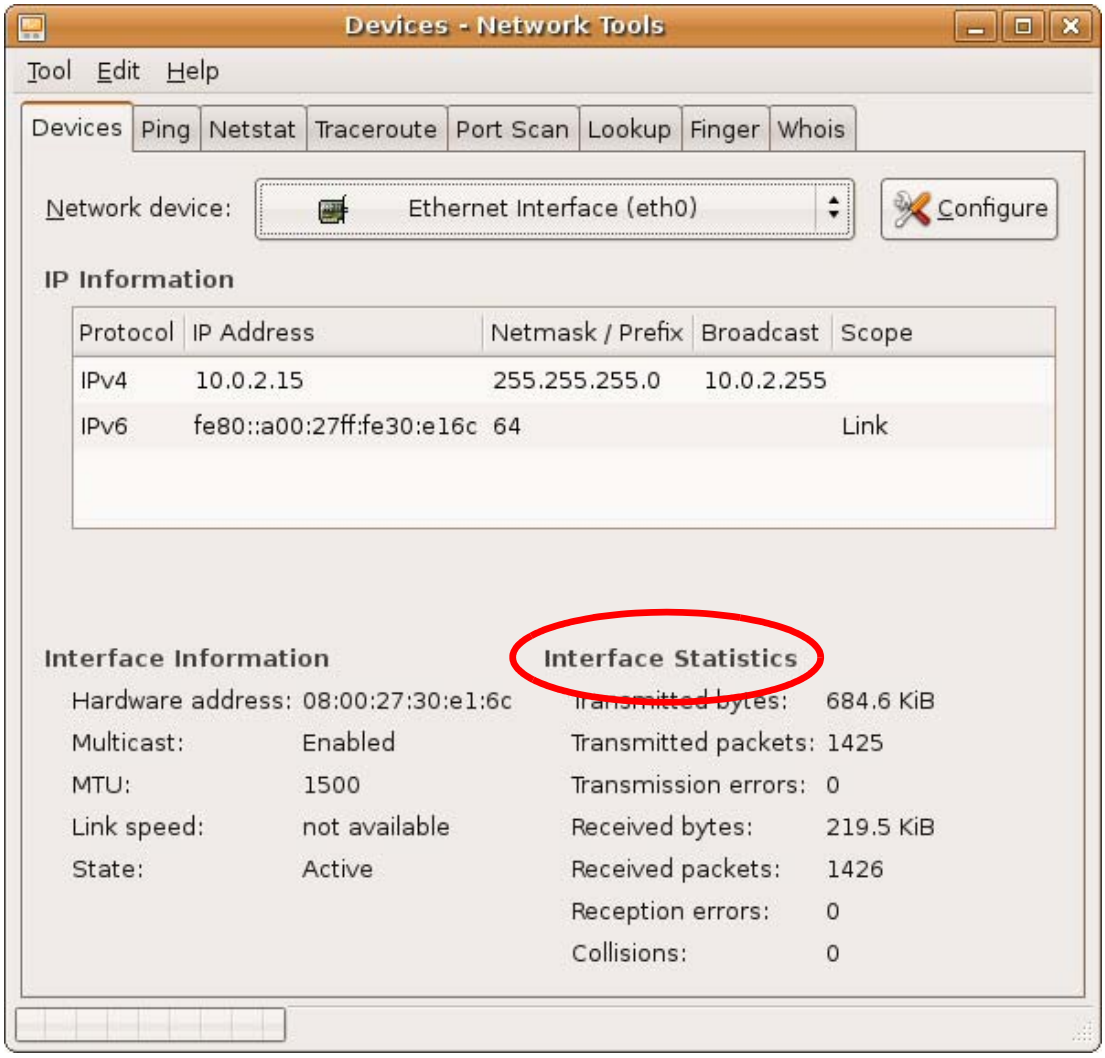
8 Click the **Close** button to apply the changes.

Verifying Settings

Check your TCP/IP properties by clicking **System > Administration > Network Tools**, and then selecting the appropriate **Network device** from the **Devices**

tab. The **Interface Statistics** column shows data if your connection is working properly.

Figure 136 Ubuntu 8: Network Tools



Linux: openSUSE 10.3 (KDE)

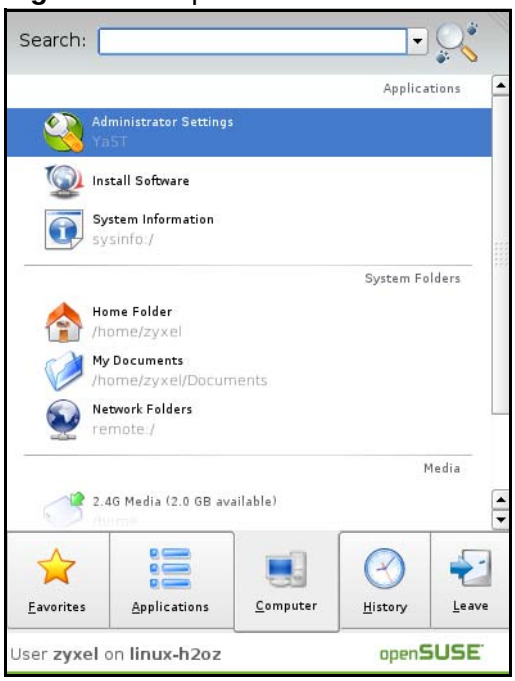
This section shows you how to configure your computer's TCP/IP settings in the K Desktop Environment (KDE) using the openSUSE 10.3 Linux distribution. The procedure, screens and file locations may vary depending on your specific distribution, release version, and individual configuration. The following screens use the default openSUSE 10.3 installation.

Note: Make sure you are logged in as the root administrator.

Follow the steps below to configure your computer IP address in the KDE:

1 Click **K Menu > Computer > Administrator Settings (YaST)**.

Figure 137 openSUSE 10.3: K Menu > Computer Menu

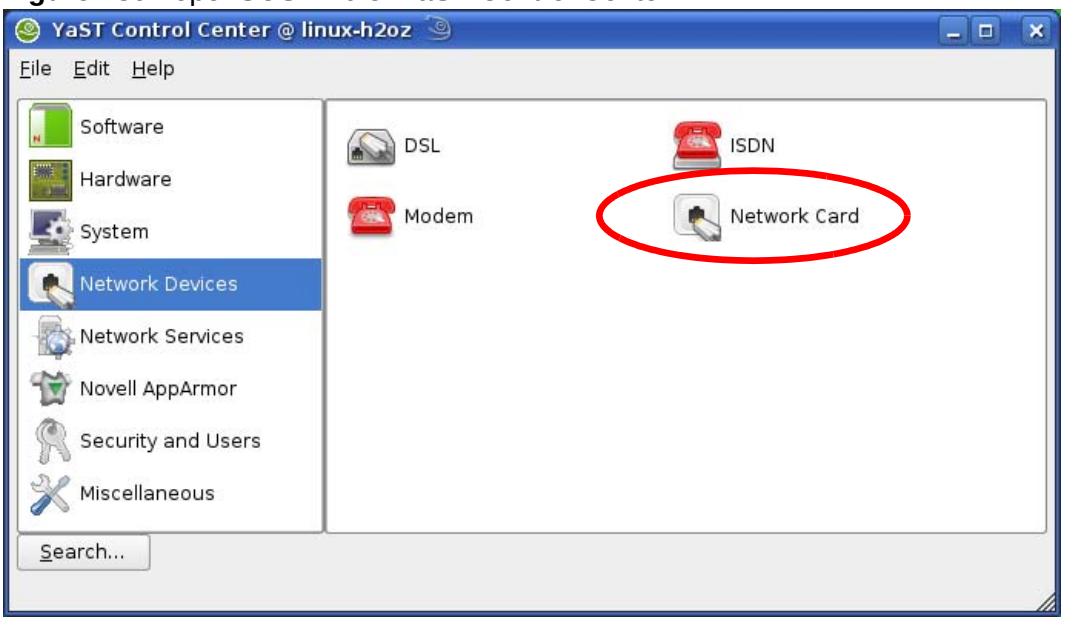


2 When the **Run as Root - KDE su** dialog opens, enter the admin password and click **OK**.

Figure 138 openSUSE 10.3: K Menu > Computer Menu

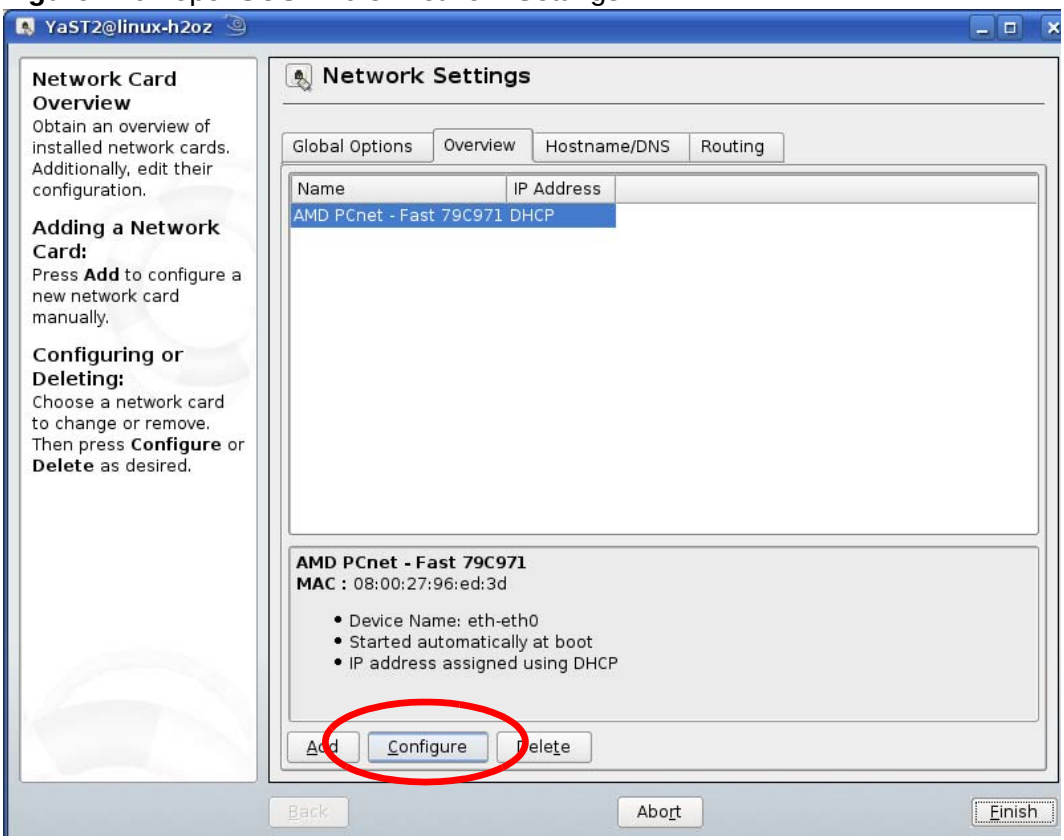
3 When the **YaST Control Center** window opens, select **Network Devices** and then click the **Network Card** icon.

Figure 139 openSUSE 10.3: YaST Control Center



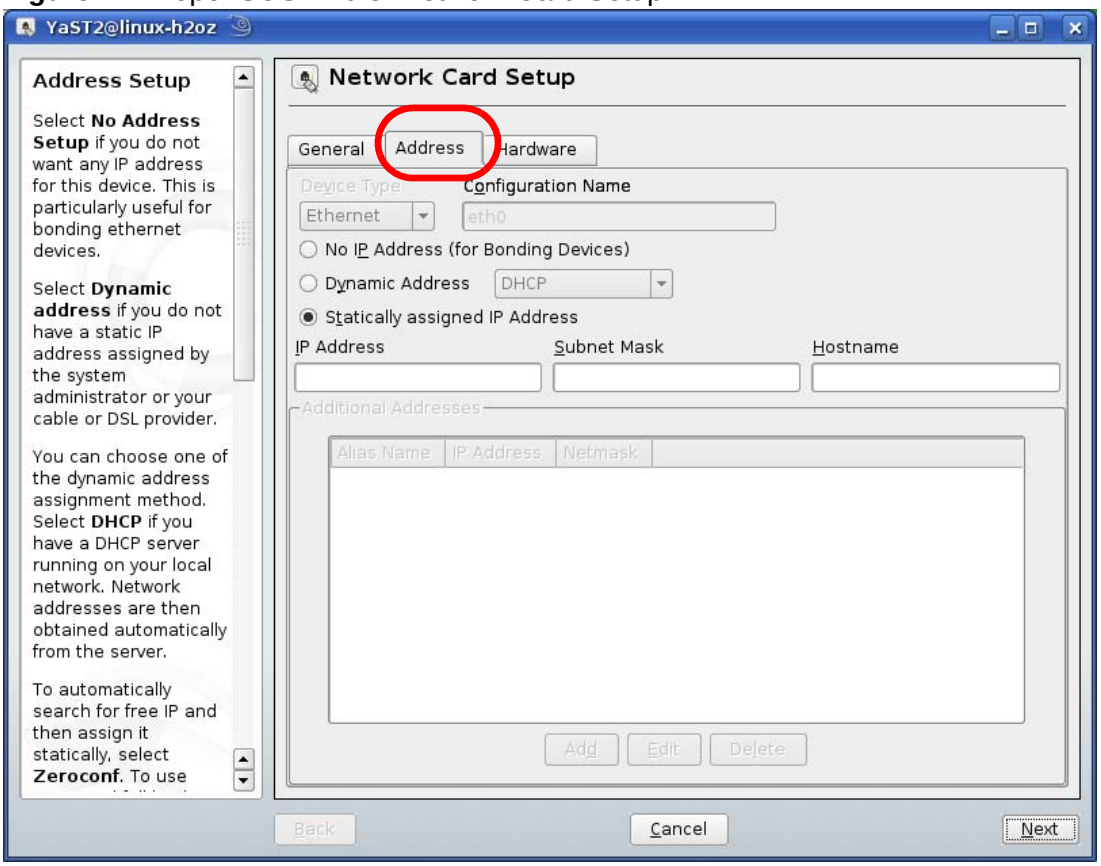
4 When the **Network Settings** window opens, click the **Overview** tab, select the appropriate connection **Name** from the list, and then click the **Configure** button.

Figure 140 openSUSE 10.3: Network Settings



5 When the **Network Card Setup** window opens, click the **Address** tab

Figure 141 openSUSE 10.3: Network Card Setup


YaST2@linux-h2oz
Address Setup
Select No Address Setup if you do not want any IP address for this device. This is particularly useful for bonding ethernet devices.
Select Dynamic address if you do not have a static IP address assigned by the system administrator or your cable or DSL provider.
You can choose one of the dynamic address assignment method. Select DHCP if you have a DHCP server running on your local network. Network addresses are then obtained automatically from the server.
To automatically search for free IP and then assign it statically, select Zeroconf. To use
Network Card Setup
General
Address
Hardware
Device Type
Configuration Name
Ethernet
eth0
No IP Address (for Bonding Devices)
Dynamic Address
DHCP
Statically assigned IP Address
IP Address
Subnet Mask
Hostname
Additional Addresses
Alias Name
IP Address
Netmask
Add
Edit
Delete
Back
Cancel
Next

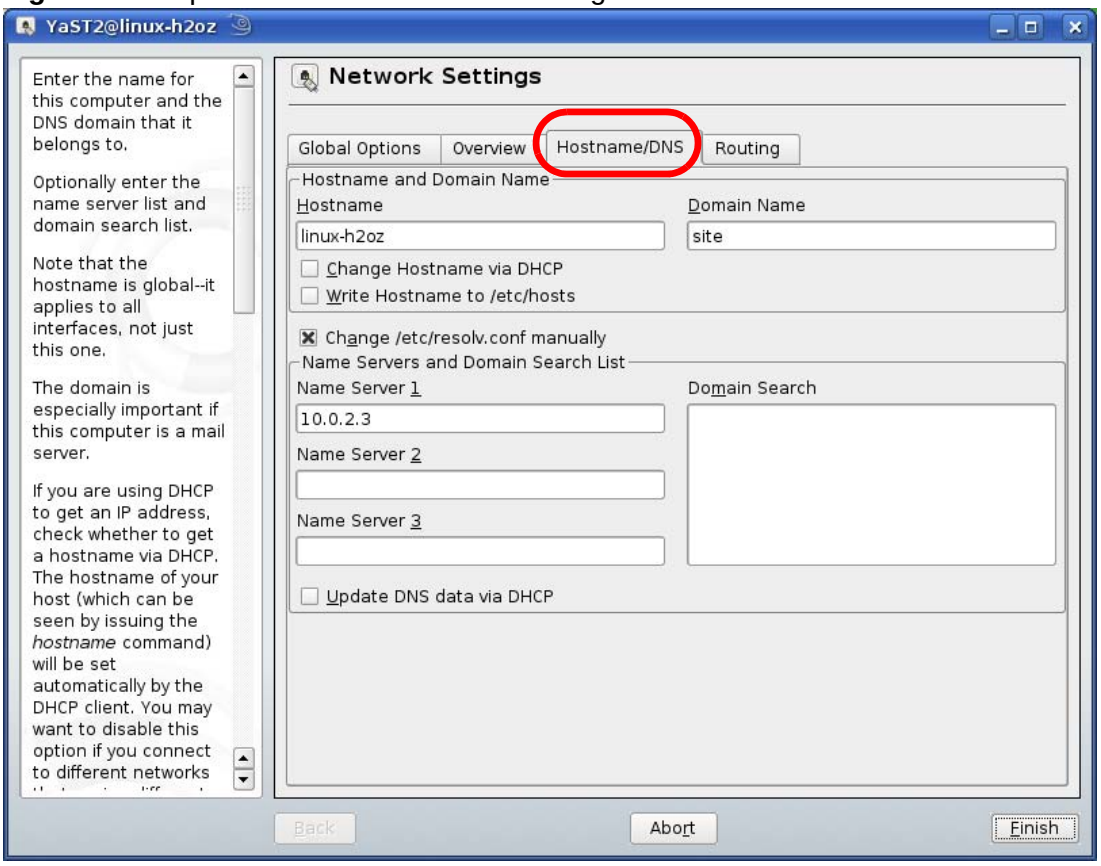
6 Select **Dynamic Address (DHCP)** if you have a dynamic IP address.

Select **Statically assigned IP Address** if you have a static IP address. Fill in the **IP address**, **Subnet mask**, and **Hostname** fields.

7 Click **Next** to save the changes and close the **Network Card Setup** window.

8 If you know your DNS server IP address(es), click the **Hostname/DNS** tab in **Network Settings** and then enter the DNS server information in the fields provided.

Figure 142 openSUSE 10.3: Network Settings


YaST2@linux-h2oz
Enter the name for this computer and the DNS domain that it belongs to.
Optionally enter the name server list and domain search list.
Note that the hostname is global--it applies to all interfaces, not just this one.
The domain is especially important if this computer is a mail server.
If you are using DHCP to get an IP address, check whether to get a hostname via DHCP. The hostname of your host (which can be seen by issuing the hostname command) will be set automatically by the DHCP client. You may want to disable this option if you connect to different networks
Network Settings
Global Options
Overview
Hostname/DNS
Routing
Hostname and Domain Name
Hostname
linux-h2oz
Domain Name
site
Change Hostname via DHCP
Write Hostname to /etc/hosts
Change /etc/resolv.conf manually
Name Servers and Domain Search List
Name Server 1
10.0.2.3
Domain Search
Name Server 2
Name Server 3
Update DNS data via DHCP
Back
Abort
Finish

9 Click **Finish** to save your settings and close the window.

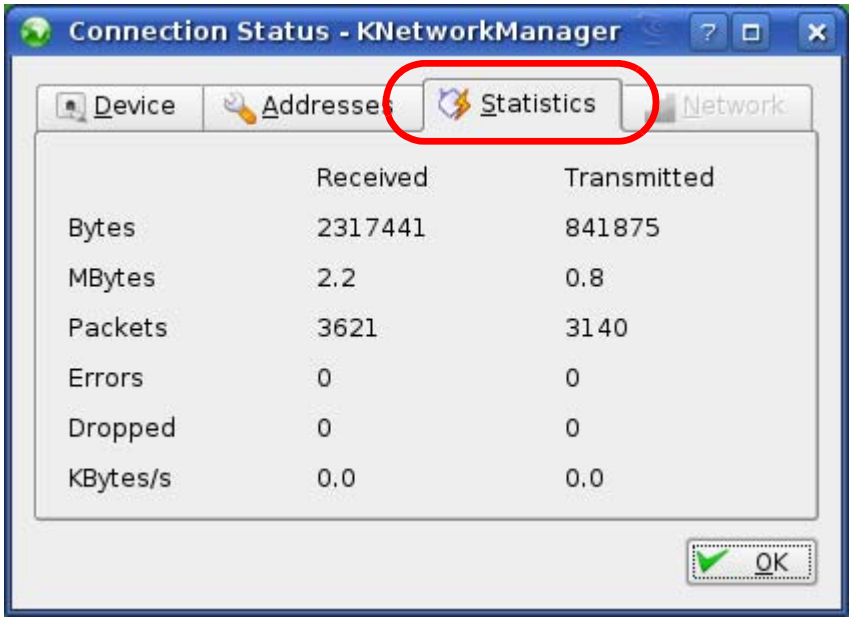
Verifying Settings

Click the **KNetwork Manager** icon on the **Task bar** to check your TCP/IP properties. From the **Options** sub-menu, select **Show Connection Information**.

Figure 143 openSUSE 10.3: KNetwork Manager

When the **Connection Status - KNetwork Manager** window opens, click the **Statistics tab** to see if your connection is working properly.

Figure 144 openSUSE: Connection Status - KNetwork Manager



C

Pop-up Windows, JavaScripts and Java Permissions

In order to use the web configurator you need to allow:

- Web browser pop-up windows from your device.
- JavaScripts (enabled by default).
- Java permissions (enabled by default).

Note: Internet Explorer 6 screens are used here. Screens for other Internet Explorer versions may vary.

Internet Explorer Pop-up Blockers

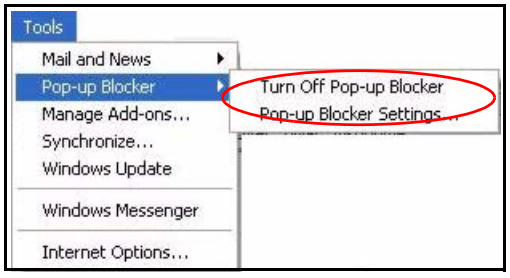
You may have to disable pop-up blocking to log into your device.

Either disable pop-up blocking (enabled by default in Windows XP SP (Service Pack) 2) or allow pop-up blocking and create an exception for your device's IP address.

Disable Pop-up Blockers

1 In Internet Explorer, select **Tools**, **Pop-up Blocker** and then select **Turn Off Pop-up Blocker**.

Figure 145 Pop-up Blocker



You can also check if pop-up blocking is disabled in the **Pop-up Blocker** section in the **Privacy** tab.

1 In Internet Explorer, select **Tools**, **Internet Options**, **Privacy**.

2 Clear the **Block pop-ups** check box in the **Pop-up Blocker** section of the screen. This disables any web pop-up blockers you may have enabled.

Figure 146 Internet Options: Privacy

3 Click **Apply** to save this setting.

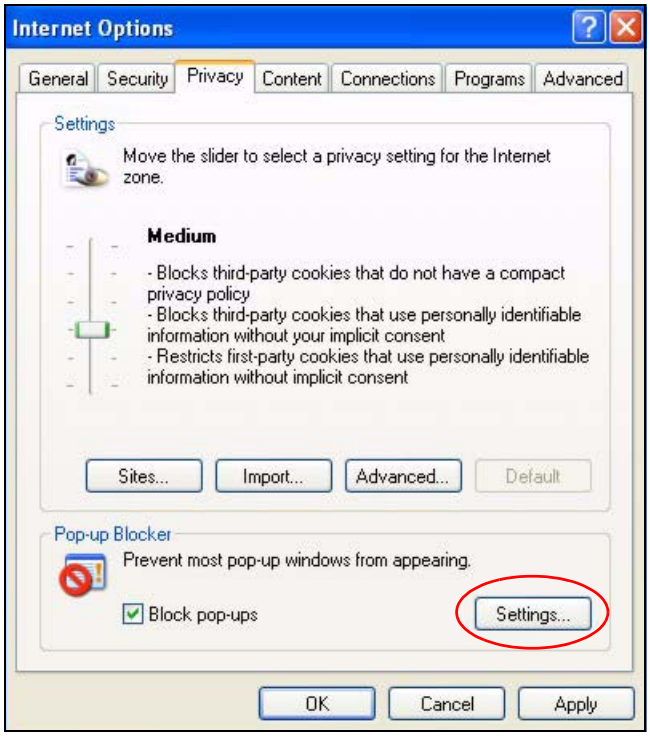
Enable Pop-up Blockers with Exceptions

Alternatively, if you only want to allow pop-up windows from your device, see the following steps.

1 In Internet Explorer, select **Tools**, **Internet Options** and then the **Privacy** tab.

2 Select **Settings...**to open the **Pop-up Blocker Settings** screen.

Figure 147 Internet Options: Privacy



3 Type the IP address of your device (the web page that you do not want to have blocked) with the prefix “http://”. For example, http://192.168.167.1.

4 Click **Add** to move the IP address to the list of **Allowed sites**.

Figure 148 Pop-up Blocker Settings

Pop-up Blocker Settings
Exceptions
Pop-ups are currently blocked. You can allow pop-ups from specific Web sites by adding the site to the list below.
Address of Web site to allow:
http://192.168.1.1
Add
Allowed sites:
Remove
Remove All
Notifications and Filter Level
Play a sound when a pop-up is blocked.
Show Information Bar when a pop-up is blocked.
Filter Level:
Medium: Block most automatic pop-ups
Pop-up Blocker FAQ
Close

5 Click **Close** to return to the **Privacy** screen.

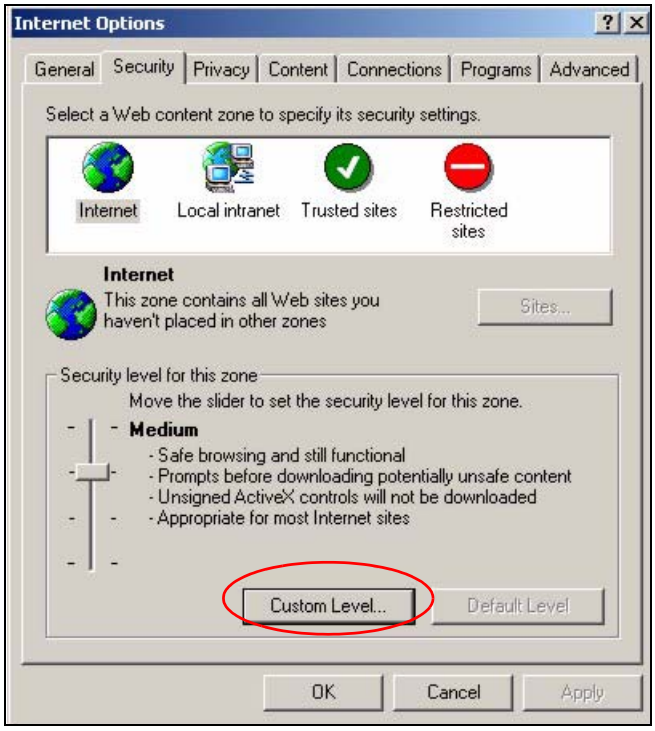
6 Click **Apply** to save this setting.

JavaScripts

If pages of the web configurator do not display properly in Internet Explorer, check that JavaScripts are allowed.

1 In Internet Explorer, click **Tools**, **Internet Options** and then the **Security** tab.

Figure 149 Internet Options: Security



2 Click the **Custom Level...** button.

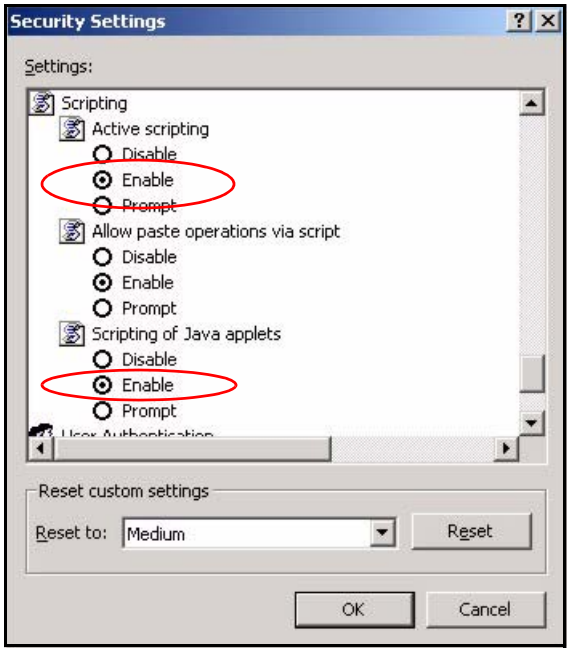
3 Scroll down to **Scripting**.

4 Under **Active scripting** make sure that **Enable** is selected (the default).

5 Under **Scripting of Java applets** make sure that **Enable** is selected (the default).

6 Click **OK** to close the window.

Figure 150 Security Settings - Java Scripting



Java Permissions

1 From Internet Explorer, click **Tools**, **Internet Options** and then the **Security** tab.

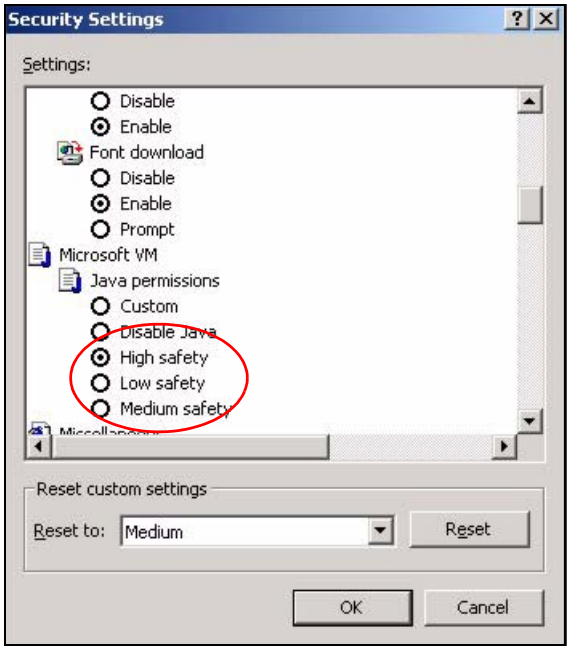
2 Click the **Custom Level...** button.

3 Scroll down to **Microsoft VM**.

4 Under **Java permissions** make sure that a safety level is selected.

5 Click **OK** to close the window.

Figure 151 Security Settings - Java



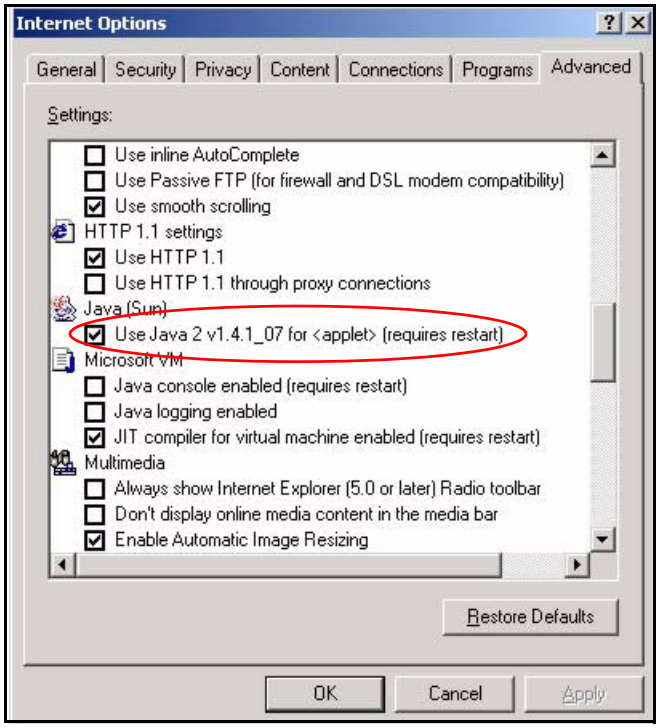
JAVA (Sun)

1 From Internet Explorer, click **Tools**, **Internet Options** and then the **Advanced** tab.

2 Make sure that **Use Java 2 for <applet>** under **Java (Sun)** is selected.

3 Click **OK** to close the window.

Figure 152 Java (Sun)

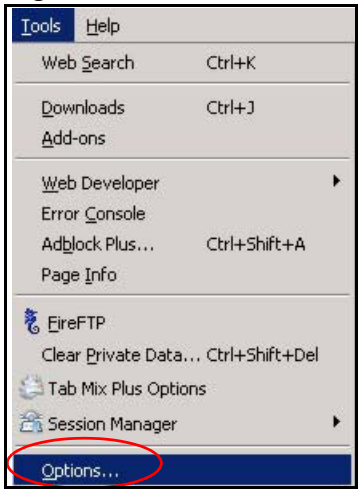


Mozilla Firefox

Mozilla Firefox 2.0 screens are used here. Screens for other versions may vary.

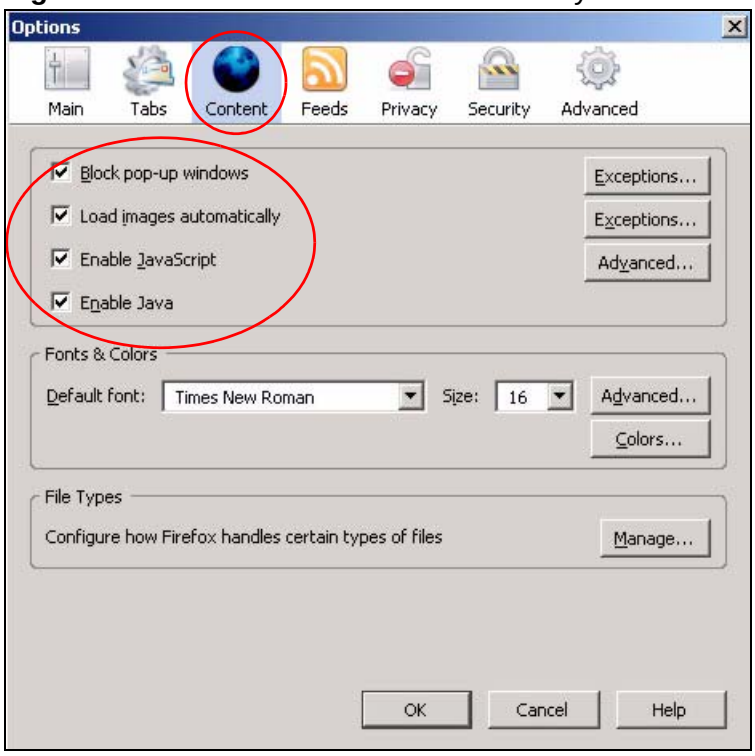
You can enable Java, Javascripts and pop-ups in one screen. Click **Tools,** then click **Options** in the screen that appears.

Figure 153 Mozilla Firefox: TOOLS > Options



Click **Content**.to show the screen below. Select the check boxes as shown in the following screen.

Figure 154 Mozilla Firefox Content Security



D

IP Addresses and Subnetting

This appendix introduces IP addresses and subnet masks.

IP addresses identify individual devices on a network. Every networking device (including computers, servers, routers, printers, etc.) needs an IP address to communicate across the network. These networking devices are also known as hosts.

Subnet masks determine the maximum number of possible hosts on a network. You can also use subnet masks to divide one network into multiple sub-networks.

Introduction to IP Addresses

One part of the IP address is the network number, and the other part is the host ID. In the same way that houses on a street share a common street name, the hosts on a network share a common network number. Similarly, as each house has its own house number, each host on the network has its own unique identifying number - the host ID. Routers use the network number to send packets to the correct network, while the host ID determines to which host on the network the packets are delivered.

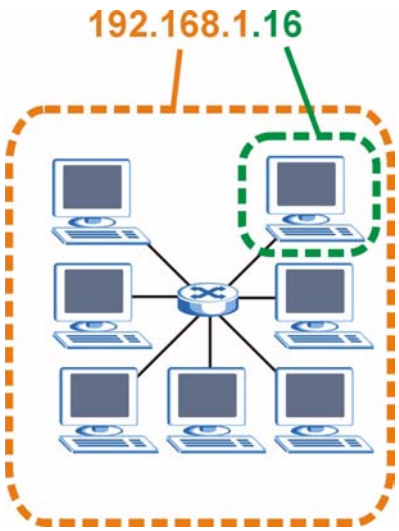
Structure

An IP address is made up of four parts, written in dotted decimal notation (for example, 192.168.1.1). Each of these four parts is known as an octet. An octet is an eight-digit binary number (for example 11000000, which is 192 in decimal notation).

Therefore, each octet has a possible range of 00000000 to 11111111 in binary, or 0 to 255 in decimal.

The following figure shows an example IP address in which the first three octets (192.168.1) are the network number, and the fourth octet (16) is the host ID.

Figure 155 Network Number and Host ID



How much of the IP address is the network number and how much is the host ID varies according to the subnet mask.

Subnet Masks

A subnet mask is used to determine which bits are part of the network number, and which bits are part of the host ID (using a logical AND operation). The term “subnet” is short for “sub-network”.

A subnet mask has 32 bits. If a bit in the subnet mask is a “1” then the corresponding bit in the IP address is part of the network number. If a bit in the subnet mask is “0” then the corresponding bit in the IP address is part of the host ID.

The following example shows a subnet mask identifying the network number (in bold text) and host ID of an IP address (192.168.1.2 in decimal).

Table 115 IP Address Network Number and Host ID Example

	1ST OCTET: (192)	2ND OCTET: (168)	3RD OCTET: (1)	4TH OCTET (2)
IP Address (Binary)	11000000	10101000	00000001	00000010
Subnet Mask (Binary)	**11111111**	**11111111**	**11111111**	00000000
Network Number	**11000000**	**10101000**	**00000001**	
Host ID				00000010

By convention, subnet masks always consist of a continuous sequence of ones beginning from the leftmost bit of the mask, followed by a continuous sequence of zeros, for a total number of 32 bits.

Subnet masks can be referred to by the size of the network number part (the bits with a “1” value). For example, an “8-bit mask” means that the first 8 bits of the mask are ones and the remaining 24 bits are zeroes.

Subnet masks are expressed in dotted decimal notation just like IP addresses. The following examples show the binary and decimal notation for 8-bit, 16-bit, 24-bit and 29-bit subnet masks.

Table 116 Subnet Masks

	BINARY				DECIMAL
	1ST OCTET	2ND OCTET	3RD OCTET	4TH OCTET	
8-bit mask	11111111	00000000	00000000	00000000	255.0.0.0
16-bit mask	11111111	11111111	00000000	00000000	255.255.0.0
24-bit mask	11111111	11111111	11111111	00000000	255.255.255.0
29-bit mask	11111111	11111111	11111111	11111000	255.255.255.248

Network Size

The size of the network number determines the maximum number of possible hosts you can have on your network. The larger the number of network number bits, the smaller the number of remaining host ID bits.

An IP address with host IDs of all zeros is the IP address of the network (192.168.1.0 with a 24-bit subnet mask, for example). An IP address with host IDs of all ones is the broadcast address for that network (192.168.1.255 with a 24-bit subnet mask, for example).

As these two IP addresses cannot be used for individual hosts, calculate the maximum number of possible hosts in a network as follows:

Table 117 Maximum Host Numbers

SUBNET MASK		HOST ID SIZE		MAXIMUM NUMBER OF HOSTS
8 bits	255.0.0.0	24 bits	$2^{24} – 2$	16777214
16 bits	255.255.0.0	16 bits	$2^{16} – 2$	65534
24 bits	255.255.255.0	8 bits	$2^{8} – 2$	254
29 bits	255.255.255.248	3 bits	$2^{3} – 2$	6

Notation

Since the mask is always a continuous number of ones beginning from the left, followed by a continuous number of zeros for the remainder of the 32 bit mask, you can simply specify the number of ones instead of writing the value of each octet. This is usually specified by writing a "/" followed by the number of bits in the mask after the address.

For example, 192.1.1.0 /25 is equivalent to saying 192.1.1.0 with subnet mask 255.255.255.128.

The following table shows some possible subnet masks using both notations.

Table 118 Alternative Subnet Mask Notation

SUBNET MASK	ALTERNATIVE NOTATION	LAST OCTET (BINARY)	LAST OCTET (DECIMAL)
255.255.255.0	/24	0000 0000	0
255.255.255.128	/25	1000 0000	128
255.255.255.192	/26	1100 0000	192
255.255.255.224	/27	1110 0000	224
255.255.255.240	/28	1111 0000	240
255.255.255.248	/29	1111 1000	248
255.255.255.252	/30	1111 1100	252

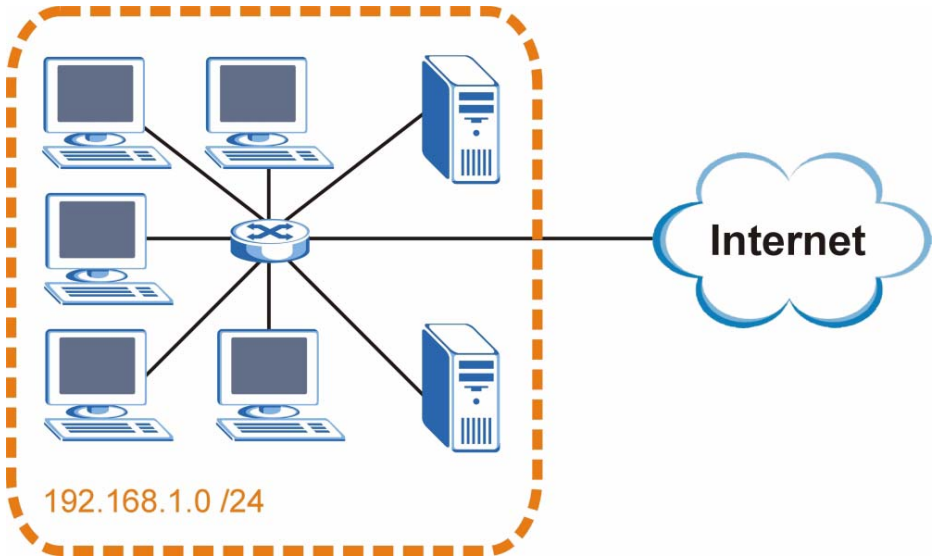
Subnetting

You can use subnetting to divide one network into multiple sub-networks. In the following example a network administrator creates two sub-networks to isolate a group of servers from the rest of the company network for security reasons.

In this example, the company network address is 192.168.1.0. The first three octets of the address (192.168.1) are the network number, and the remaining octet is the host ID, allowing a maximum of 2^8 – 2 or 254 possible hosts.

The following figure shows the company network before subnetting.

Figure 156 Subnetting Example: Before Subnetting

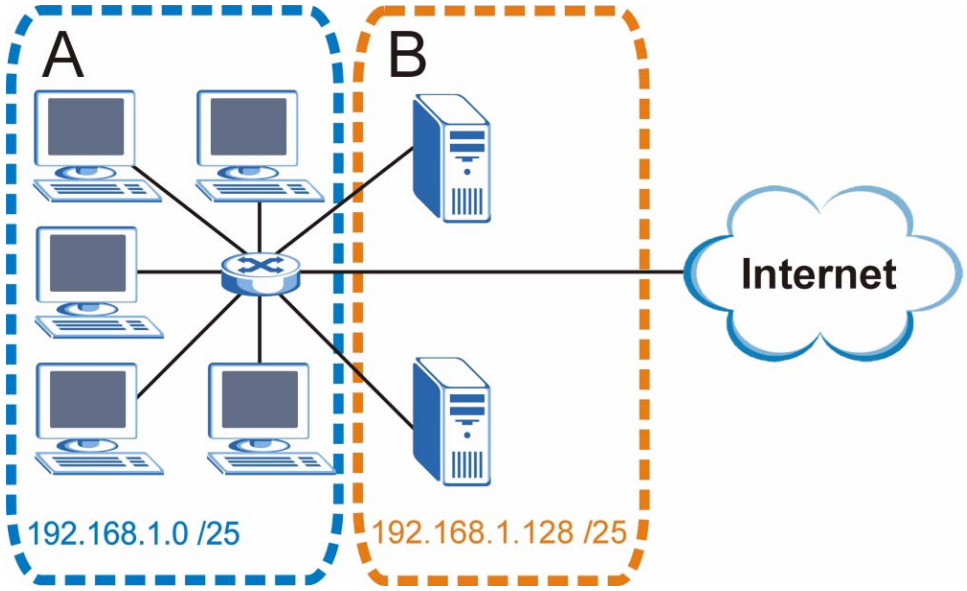


You can “borrow” one of the host ID bits to divide the network 192.168.1.0 into two separate sub-networks. The subnet mask is now 25 bits (255.255.255.128 or /25).

The “borrowed” host ID bit can have a value of either 0 or 1, allowing two subnets; 192.168.1.0 /25 and 192.168.1.128 /25.

The following figure shows the company network after subnetting. There are now two sub-networks, **A** and **B**.

Figure 157 Subnetting Example: After Subnetting



In a 25-bit subnet the host ID has 7 bits, so each sub-network has a maximum of 2^7 – 2 or 126 possible hosts (a host ID of all zeroes is the subnet's address itself, all ones is the subnet's broadcast address).

192.168.1.0 with mask 255.255.255.128 is subnet **A** itself, and 192.168.1.127 with mask 255.255.255.128 is its broadcast address. Therefore, the lowest IP address that can be assigned to an actual host for subnet **A** is 192.168.1.1 and the highest is 192.168.1.126.

Similarly, the host ID range for subnet **B** is 192.168.1.129 to 192.168.1.254.

Example: Four Subnets

The previous example illustrated using a 25-bit subnet mask to divide a 24-bit address into two subnets. Similarly, to divide a 24-bit address into four subnets, you need to "borrow" two host ID bits to give four possible combinations (00, 01, 10 and 11). The subnet mask is 26 bits (11111111.11111111.11111111.**11**000000) or 255.255.255.192.

Each subnet contains 6 host ID bits, giving 2^6 - 2 or 62 hosts for each subnet (a host ID of all zeroes is the subnet itself, all ones is the subnet's broadcast address).

Table 119 Subnet 1

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address (Decimal)	192.168.1.	0
IP Address (Binary)	11000000.10101000.00000001.	**00**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.0	Lowest Host ID: 192.168.1.1	
Broadcast Address: 192.168.1.63	Highest Host ID: 192.168.1.62	

Table 120 Subnet 2

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address	192.168.1.	64
IP Address (Binary)	11000000.10101000.00000001.	**01**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.64	Lowest Host ID: 192.168.1.65	
Broadcast Address: 192.168.1.127	Highest Host ID: 192.168.1.126	

Table 121 Subnet 3

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address	192.168.1.	128
IP Address (Binary)	11000000.10101000.00000001.	**10**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.128	Lowest Host ID: 192.168.1.129	
Broadcast Address: 192.168.1.191	Highest Host ID: 192.168.1.190	

Table 122 Subnet 4

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address	192.168.1.	192
IP Address (Binary)	11000000.10101000.00000001.	**11**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000

Table 122 Subnet 4 (continued)

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
Subnet Address: 192.168.1.192	Lowest Host ID: 192.168.1.193	
Broadcast Address: 192.168.1.255	Highest Host ID: 192.168.1.254	

Example: Eight Subnets

Similarly, use a 27-bit mask to create eight subnets (000, 001, 010, 011, 100, 101, 110 and 111).

The following table shows IP address last octet values for each subnet.

Table 123 Eight Subnets

SUBNET	SUBNET ADDRESS	FIRST ADDRESS	LAST ADDRESS	BROADCAST ADDRESS
1	0	1	30	31
2	32	33	62	63
3	64	65	94	95
4	96	97	126	127
5	128	129	158	159
6	160	161	190	191
7	192	193	222	223
8	224	225	254	255

Subnet Planning

The following table is a summary for subnet planning on a network with a 24-bit network number.

Table 124 24-bit Network Number Subnet Planning

NO. “BORROWED” HOST BITS	SUBNET MASK	NO. SUBNETS	NO. HOSTS PER SUBNET
1	255.255.255.128 (/25)	2	126
2	255.255.255.192 (/26)	4	62
3	255.255.255.224 (/27)	8	30
4	255.255.255.240 (/28)	16	14
5	255.255.255.248 (/29)	32	6
6	255.255.255.252 (/30)	64	2
7	255.255.255.254 (/31)	128	1

The following table is a summary for subnet planning on a network with a 16-bit network number.

Table 125 16-bit Network Number Subnet Planning

NO. "BORROWED" HOST BITS	SUBNET MASK	NO. SUBNETS	NO. HOSTS PER SUBNET
1	255.255.128.0 (/17)	2	32766
2	255.255.192.0 (/18)	4	16382
3	255.255.224.0 (/19)	8	8190
4	255.255.240.0 (/20)	16	4094
5	255.255.248.0 (/21)	32	2046
6	255.255.252.0 (/22)	64	1022
7	255.255.254.0 (/23)	128	510
8	255.255.255.0 (/24)	256	254
9	255.255.255.128 (/25)	512	126
10	255.255.255.192 (/26)	1024	62
11	255.255.255.224 (/27)	2048	30
12	255.255.255.240 (/28)	4096	14
13	255.255.255.248 (/29)	8192	6
14	255.255.255.252 (/30)	16384	2
15	255.255.255.254 (/31)	32768	1

Configuring IP Addresses

Where you obtain your network number depends on your particular situation. If the ISP or your network administrator assigns you a block of registered IP addresses, follow their instructions in selecting the IP addresses and the subnet mask.

If the ISP did not explicitly give you an IP network number, then most likely you have a single user account and the ISP will assign you a dynamic IP address when the connection is established. If this is the case, it is recommended that you select a network number from 192.168.0.0 to 192.168.255.0. The Internet Assigned Number Authority (IANA) reserved this block of addresses specifically for private use; please do not use any other number unless you are told otherwise. You must also enable Network Address Translation (NAT) on the WiMAX Modem.

Once you have decided on the network number, pick an IP address for your WiMAX Modem that is easy to remember (for instance, 192.168.1.1) but make sure that no other device on your network is using that IP address.

The subnet mask specifies the network number portion of an IP address. Your WiMAX Modem will compute the subnet mask automatically based on the IP

address that you entered. You don't need to change the subnet mask computed by the WiMAX Modem unless you are instructed to do otherwise.

Private IP Addresses

Every machine on the Internet must have a unique address. If your networks are isolated from the Internet (running only between two branch offices, for example) you can assign any IP addresses to the hosts without problems. However, the Internet Assigned Numbers Authority (IANA) has reserved the following three blocks of IP addresses specifically for private networks:

- 10.0.0.0 — 10.255.255.255
- 172.16.0.0 — 172.31.255.255
- 192.168.0.0 — 192.168.255.255

You can obtain your IP address from the IANA, from an ISP, or it can be assigned from a private network. If you belong to a small organization and your Internet access is through an ISP, the ISP can provide you with the Internet addresses for your local networks. On the other hand, if you are part of a much larger organization, you should consult your network administrator for the appropriate IP addresses.

Regardless of your particular situation, do not create an arbitrary IP address; always follow the guidelines above. For more information on address assignment, please refer to RFC 1597, Address Allocation for Private Internets and RFC 1466, Guidelines for Management of IP Address Space.

IP Address Conflicts

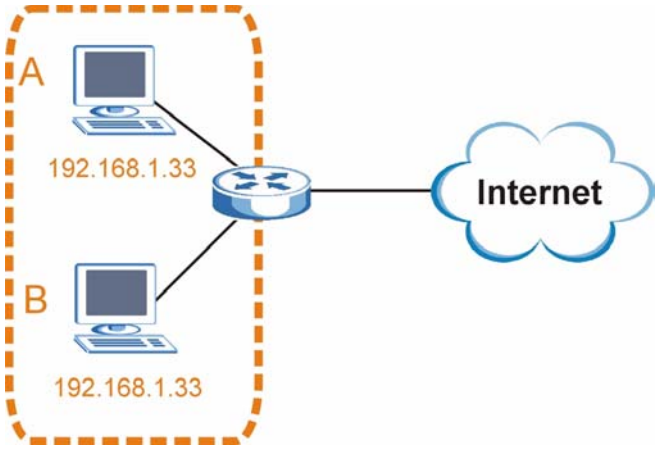
Each device on a network must have a unique IP address. Devices with duplicate IP addresses on the same network will not be able to access the Internet or other resources. The devices may also be unreachable through the network.

Conflicting Computer IP Addresses Example

More than one device can not use the same IP address. In the following example computer **A** has a static (or fixed) IP address that is the same as the IP address that a DHCP server assigns to computer **B** which is a DHCP client. Neither can access the Internet. This problem can be solved by assigning a different static IP

address to computer **A** or setting computer **A** to obtain an IP address automatically.

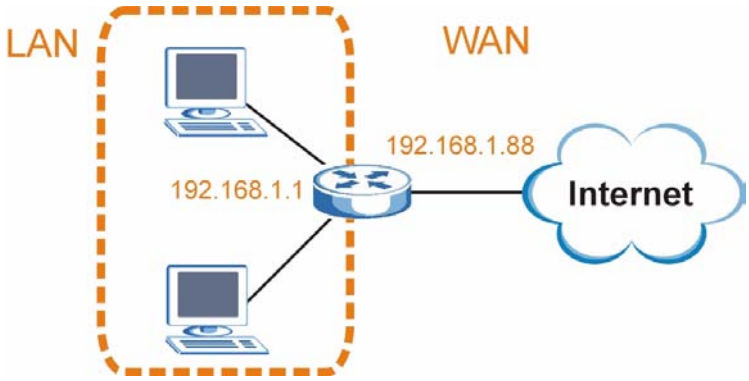
Figure 158 Conflicting Computer IP Addresses Example



Conflicting Router IP Addresses Example

Since a router connects different networks, it must have interfaces using different network numbers. For example, if a router is set between a LAN and the Internet (WAN), the router's LAN and WAN addresses must be on different subnets. In the following example, the LAN and WAN are on the same subnet. The LAN computers cannot access the Internet because the router cannot route between networks.

Figure 159 Conflicting Computer IP Addresses Example

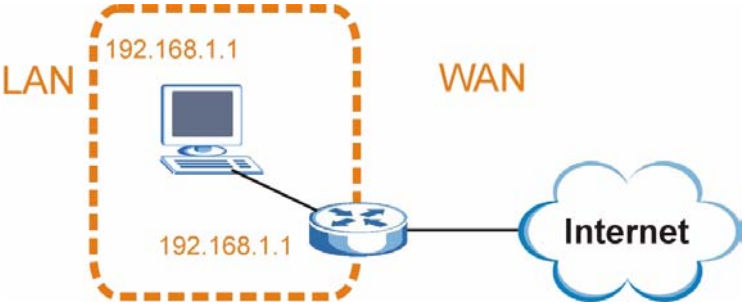


Conflicting Computer and Router IP Addresses Example

More than one device can not use the same IP address. In the following example, the computer and the router's LAN port both use 192.168.1.1 as the IP address.

The computer cannot access the Internet. This problem can be solved by assigning a different IP address to the computer or the router's LAN port.

Figure 160 Conflicting Computer and Router IP Addresses Example



E

Importing Certificates

This appendix shows you how to import public key certificates into your web browser.

Public key certificates are used by web browsers to ensure that a secure web site is legitimate. When a certificate authority such as VeriSign, Comodo, or Network Solutions, to name a few, receives a certificate request from a website operator, they confirm that the web domain and contact information in the request match those on public record with a domain name registrar. If they match, then the certificate is issued to the website operator, who then places it on the site to be issued to all visiting web browsers to let them know that the site is legitimate.

Many ZyXEL products, such as the NSA-2401, issue their own public key certificates. These can be used by web browsers on a LAN or WAN to verify that they are in fact connecting to the legitimate device and not one masquerading as it. However, because the certificates were not issued by one of the several organizations officially recognized by the most common web browsers, you will need to import the ZyXEL-created certificate into your web browser and flag that certificate as a trusted authority.

Note: You can see if you are browsing on a secure website if the URL in your web browser's address bar begins with `https://` or there is a sealed padlock icon ( ) somewhere in the main browser window (not all browsers show the padlock in the same location.)

In this appendix, you can import a public key certificate for:

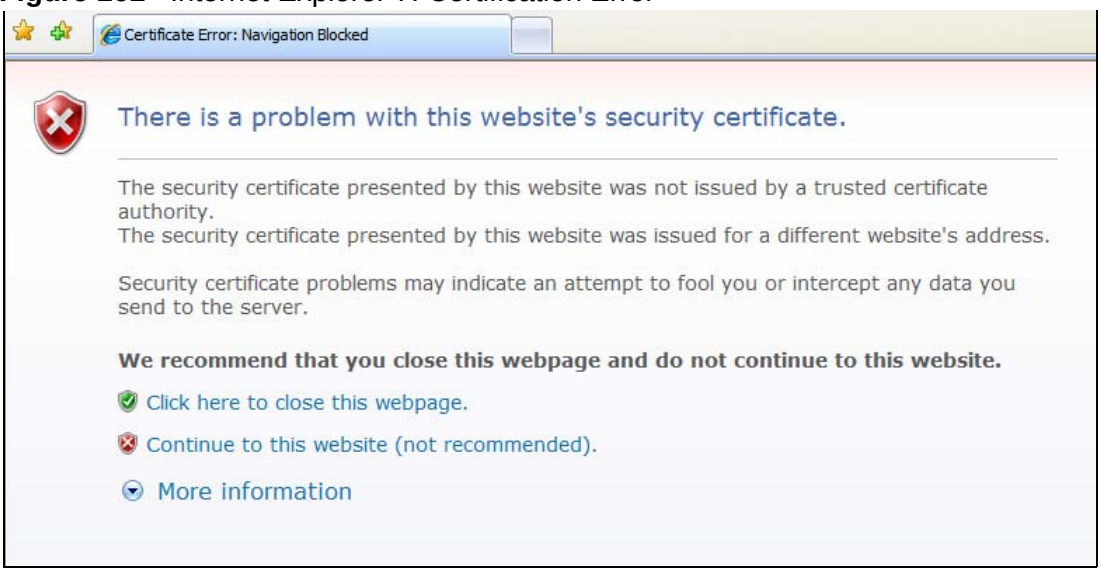
- Internet Explorer on page 322
- Firefox on page 332
- Opera on page 338
- Konqueror on page 346

Internet Explorer

The following example uses Microsoft Internet Explorer 7 on Windows XP Professional; however, they can also apply to Internet Explorer on Windows Vista.

1 If your device's web configurator is set to use SSL certification, then the first time you browse to it you are presented with a certification error.

Figure 161 Internet Explorer 7: Certification Error

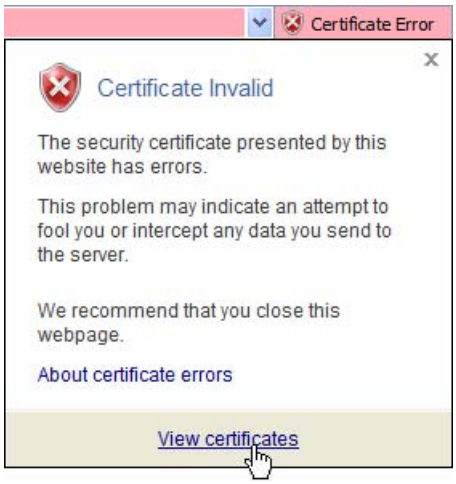

Certificate Error: Navigation Blocked
There is a problem with this website's security certificate.
The security certificate presented by this website was not issued by a trusted certificate authority.
The security certificate presented by this website was issued for a different website's address.
Security certificate problems may indicate an attempt to fool you or intercept any data you send to the server.
We recommend that you close this webpage and do not continue to this website.
Click here to close this webpage.
Continue to this website (not recommended).
More information

2 Click **Continue to this website (not recommended)**.

Figure 162 Internet Explorer 7: Certification Error

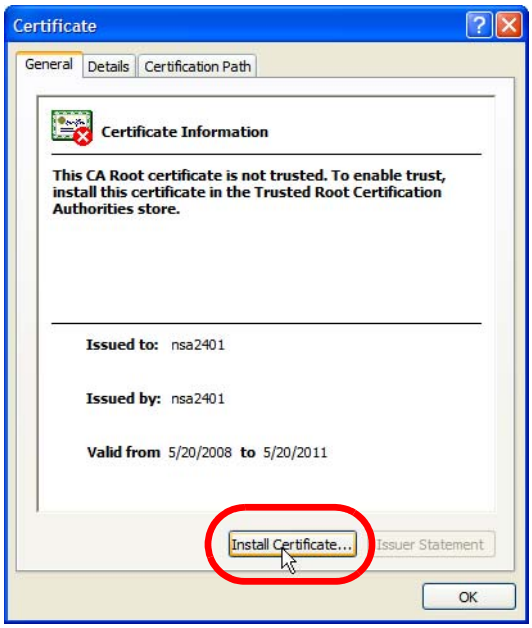
3 In the **Address Bar**, click **Certificate Error** > **View certificates**.

Figure 163 Internet Explorer 7: Certificate Error


Certificate Error
Certificate Invalid
The security certificate presented by this website has errors.
This problem may indicate an attempt to fool you or intercept any data you send to the server.
We recommend that you close this webpage.
About certificate errors
View certificates

4 In the **Certificate** dialog box, click **Install Certificate**.

Figure 164 Internet Explorer 7: Certificate



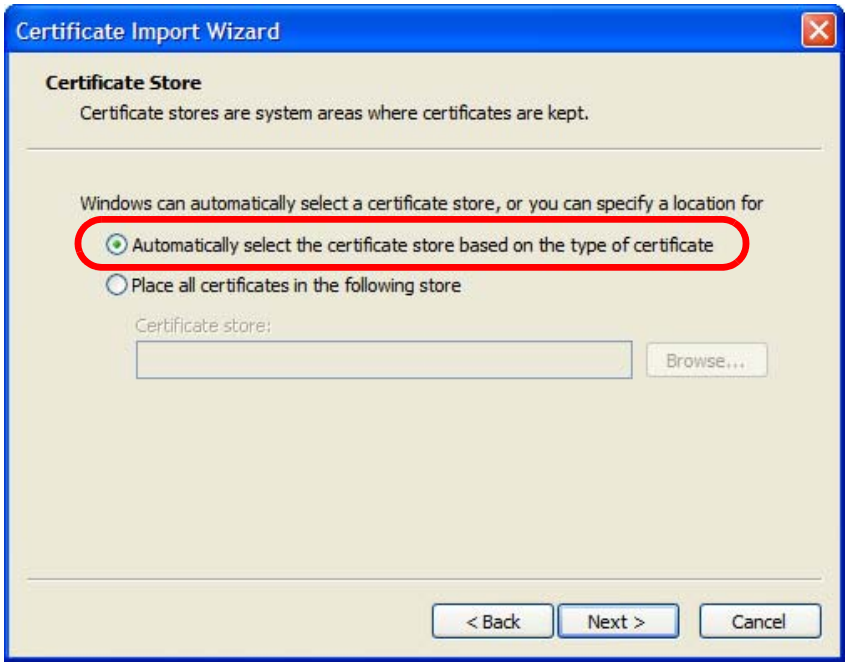
5 In the **Certificate Import Wizard**, click **Next**.

Figure 165 Internet Explorer 7: Certificate Import Wizard

Certificate Import Wizard
Welcome to the Certificate Import Wizard
This wizard helps you copy certificates, certificate trust lists, and certificate revocation lists from your disk to a certificate store.
A certificate, which is issued by a certification authority, is a confirmation of your identity and contains information used to protect data or to establish secure network connections. A certificate store is the system area where certificates are kept.
To continue, click Next.
< Back
Next >
Cancel

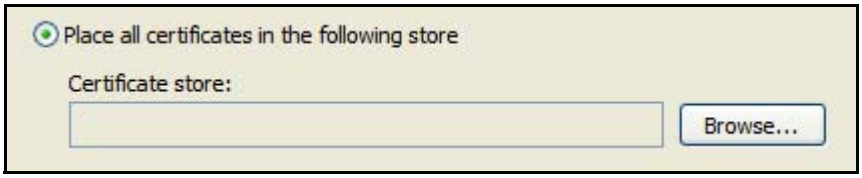
6 If you want Internet Explorer to **Automatically select certificate store based on the type of certificate**, click **Next** again and then go to step 9.

Figure 166 Internet Explorer 7: Certificate Import Wizard


Certificate Import Wizard
Certificate Store
Certificate stores are system areas where certificates are kept.
Windows can automatically select a certificate store, or you can specify a location for
Automatically select the certificate store based on the type of certificate
Place all certificates in the following store
Certificate store:
Browse...
< Back
Next >
Cancel

7 Otherwise, select **Place all certificates in the following store** and then click **Browse**.

Figure 167 Internet Explorer 7: Certificate Import Wizard

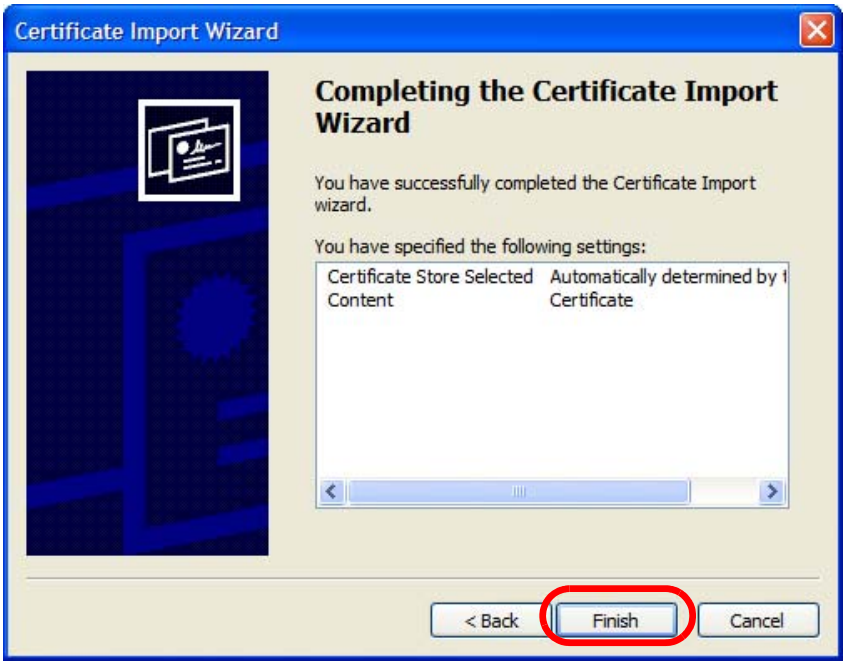


8 In the **Select Certificate Store** dialog box, choose a location in which to save the certificate and then click **OK**.

Figure 168 Internet Explorer 7: Select Certificate Store

9 In the **Completing the Certificate Import Wizard** screen, click **Finish**.

Figure 169 Internet Explorer 7: Certificate Import Wizard



10 If you are presented with another **Security Warning**, click **Yes**.

Figure 170 Internet Explorer 7: Security Warning

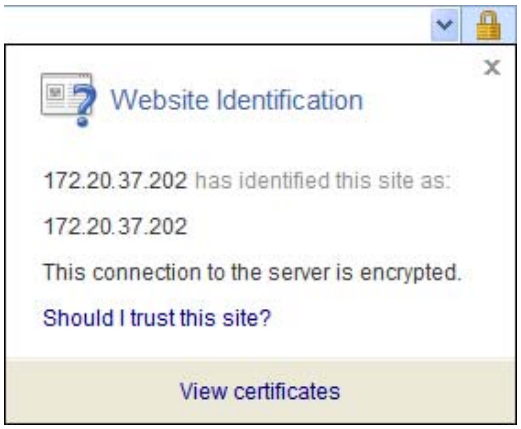
Security Warning
You are about to install a certificate from a certification authority (CA) claiming to represent:
nsa2401
Windows cannot validate that the certificate is actually from "nsa2401". You should confirm its origin by contacting "nsa2401". The following number will assist you in this process:
Thumbprint (sha1): 35D1C9AC DBC0E654 FE327C71 464D154B 242E5B93
Warning:
If you install this root certificate, Windows will automatically trust any certificate issued by this CA. Installing a certificate with an unconfirmed thumbprint is a security risk. If you click "Yes" you acknowledge this risk.
Do you want to install this certificate?
Yes
No

11 Finally, click **OK** when presented with the successful certificate installation message.

Figure 171 Internet Explorer 7: Certificate Import Wizard

12 The next time you start Internet Explorer and go to a ZyXEL web configurator page, a sealed padlock icon appears in the address bar. Click it to view the page's **Website Identification** information.

Figure 172 Internet Explorer 7: Website Identification



Installing a Stand-Alone Certificate File in Internet Explorer

Rather than browsing to a ZyXEL web configurator and installing a public key certificate when prompted, you can install a stand-alone certificate file if one has been issued to you.

1 Double-click the public key certificate file.

Figure 173 Internet Explorer 7: Public Key Certificate File

2 In the security warning dialog box, click **Open**.

Figure 174 Internet Explorer 7: Open File - Security Warning

Open File - Security Warning
Do you want to open this file?
Name: CA.cer
Publisher: Unknown Publisher
Type: Security Certificate
From: D:\Documents and Settings\13435\Desktop
Open
Cancel
Always ask before opening this file
While files from the Internet can be useful, this file type can potentially harm your computer. If you do not trust the source, do not open this software. What's the risk?

3 Refer to steps 4-12 in the Internet Explorer procedure beginning on page 322 to complete the installation process.

Removing a Certificate in Internet Explorer

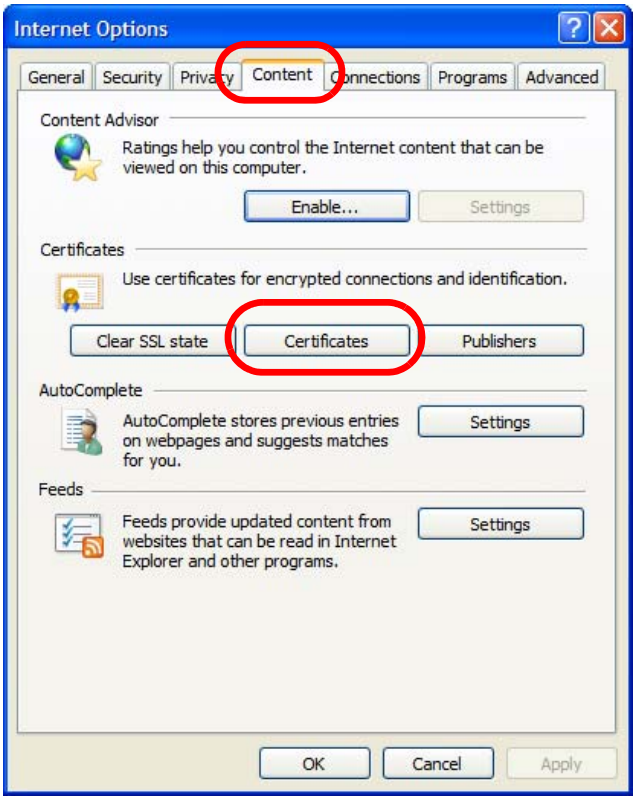
This section shows you how to remove a public key certificate in Internet Explorer 7.

1 Open **Internet Explorer** and click **TOOLS > Internet Options**.

Figure 175 Internet Explorer 7: Tools Menu

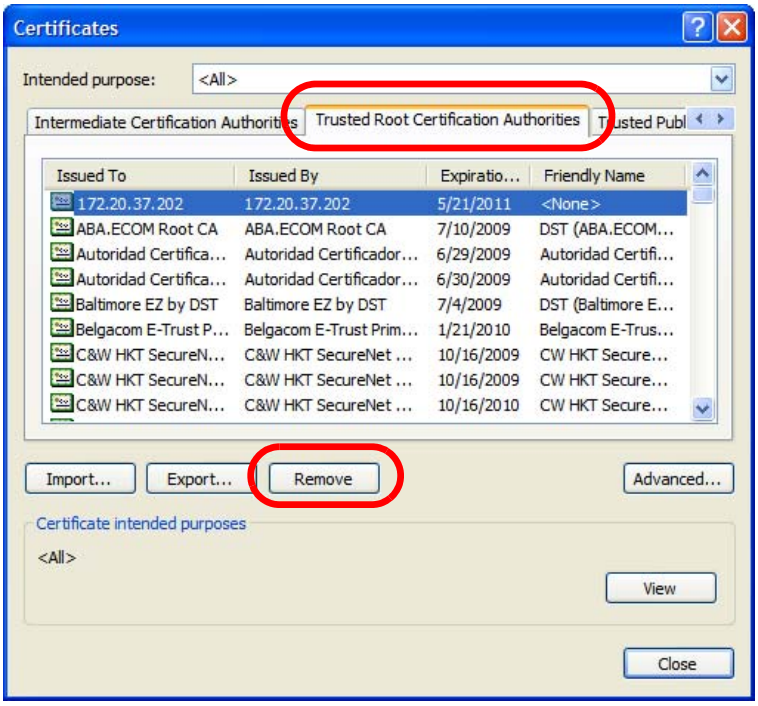
2 In the **Internet Options** dialog box, click **Content** > **Certificates**.

Figure 176 Internet Explorer 7: Internet Options



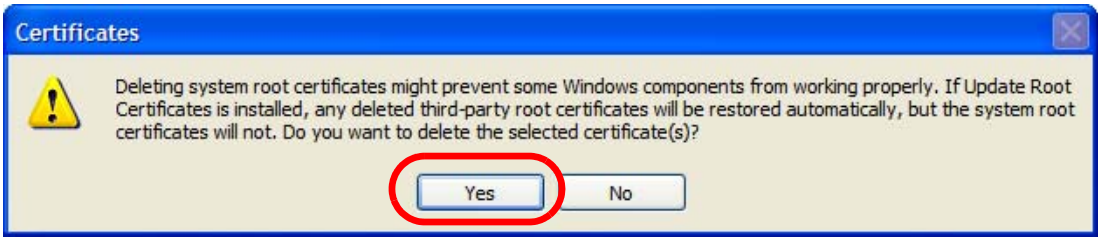
3 In the **Certificates** dialog box, click the **Trusted Root Certificates Authorities** tab, select the certificate that you want to delete, and then click **Remove**.

Figure 177 Internet Explorer 7: Certificates



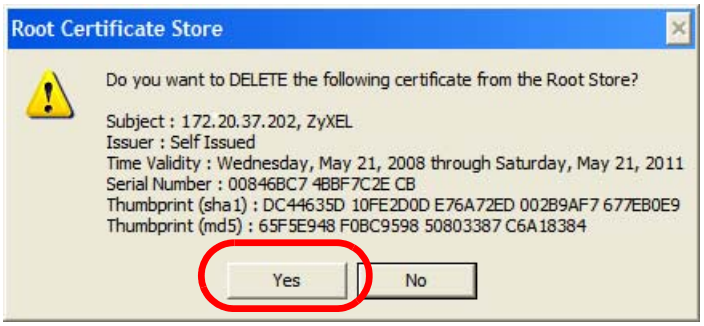
4 In the **Certificates** confirmation, click **Yes**.

Figure 178 Internet Explorer 7: Certificates


Certificates
Deleting system root certificates might prevent some Windows components from working properly. If Update Root Certificates is installed, any deleted third-party root certificates will be restored automatically, but the system root certificates will not. Do you want to delete the selected certificate(s)?
Yes
No

5 In the **Root Certificate Store** dialog box, click **Yes**.

Figure 179 Internet Explorer 7: Root Certificate Store


Root Certificate Store
Do you want to DELETE the following certificate from the Root Store?
Subject : 172.20.37.202, ZyXEL
Issuer : Self Issued
Time Validity : Wednesday, May 21, 2008 through Saturday, May 21, 2011
Serial Number : 00846BC7 4BBF7C2E CB
Thumbprint (sha1) : DC44635D 10FE2D0D E76A72ED 002B9AF7 677EB0E9
Thumbprint (md5) : 65F5E948 F0BC9598 50803387 C6A18384
Yes
No

6 The next time you go to the web site that issued the public key certificate you just removed, a certification error appears.

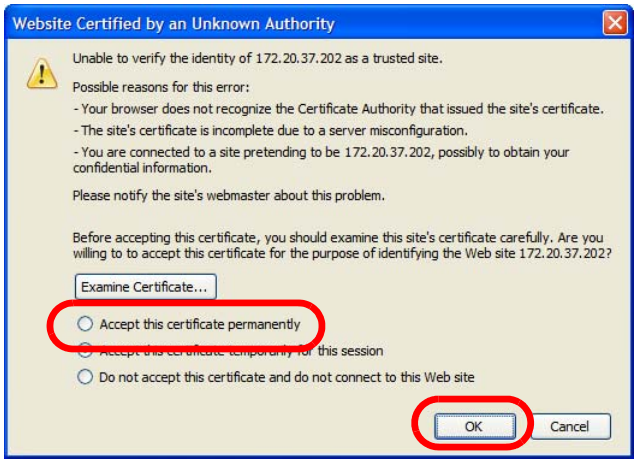
Firefox

The following example uses Mozilla Firefox 2 on Windows XP Professional; however, the screens can also apply to Firefox 2 on all platforms.

1 If your device's web configurator is set to use SSL certification, then the first time you browse to it you are presented with a certification error.

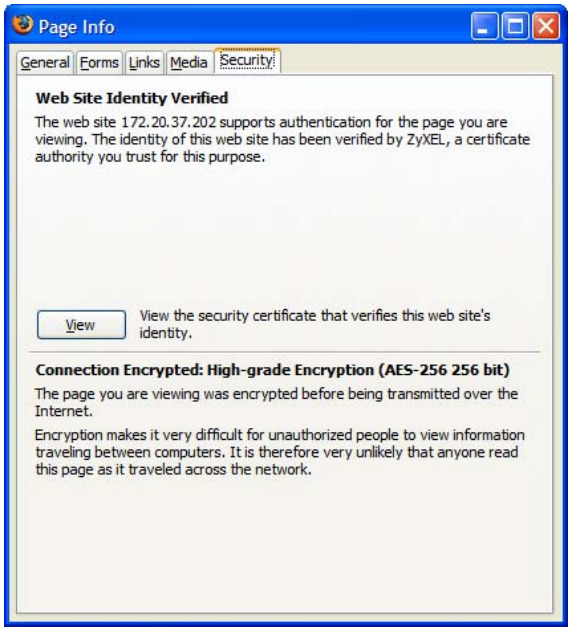
2 Select **Accept this certificate permanently** and click **OK.**

Figure 180 Firefox 2: Website Certified by an Unknown Authority


Website Certified by an Unknown Authority
Unable to verify the identity of 172.20.37.202 as a trusted site.
Possible reasons for this error:
- Your browser does not recognize the Certificate Authority that issued the site's certificate.
- The site's certificate is incomplete due to a server misconfiguration.
- You are connected to a site pretending to be 172.20.37.202, possibly to obtain your confidential information.
Please notify the site's webmaster about this problem.
Before accepting this certificate, you should examine this site's certificate carefully. Are you willing to to accept this certificate for the purpose of identifying the Web site 172.20.37.202?
Examine Certificate...
Accept this certificate permanently
Do not accept this certificate and do not connect to this Web site
OK
Cancel

3 The certificate is stored and you can now connect securely to the web configurator. A sealed padlock appears in the address bar, which you can click to open the **Page Info > Security** window to view the web page's security information.

Figure 181 Firefox 2: Page Info

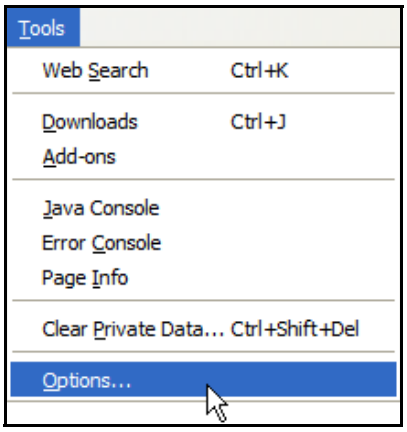

Page Info
General
Forms
Links
Media
Security
Web Site Identity Verified
The web site 172.20.37.202 supports authentication for the page you are viewing. The identity of this web site has been verified by ZyXEL, a certificate authority you trust for this purpose.
View
View the security certificate that verifies this web site's identity.
Connection Encrypted: High-grade Encryption (AES-256 256 bit)
The page you are viewing was encrypted before being transmitted over the Internet.
Encryption makes it very difficult for unauthorized people to view information traveling between computers. It is therefore very unlikely that anyone read this page as it traveled across the network.

Installing a Stand-Alone Certificate File in Firefox

Rather than browsing to a ZyXEL web configurator and installing a public key certificate when prompted, you can install a stand-alone certificate file if one has been issued to you.

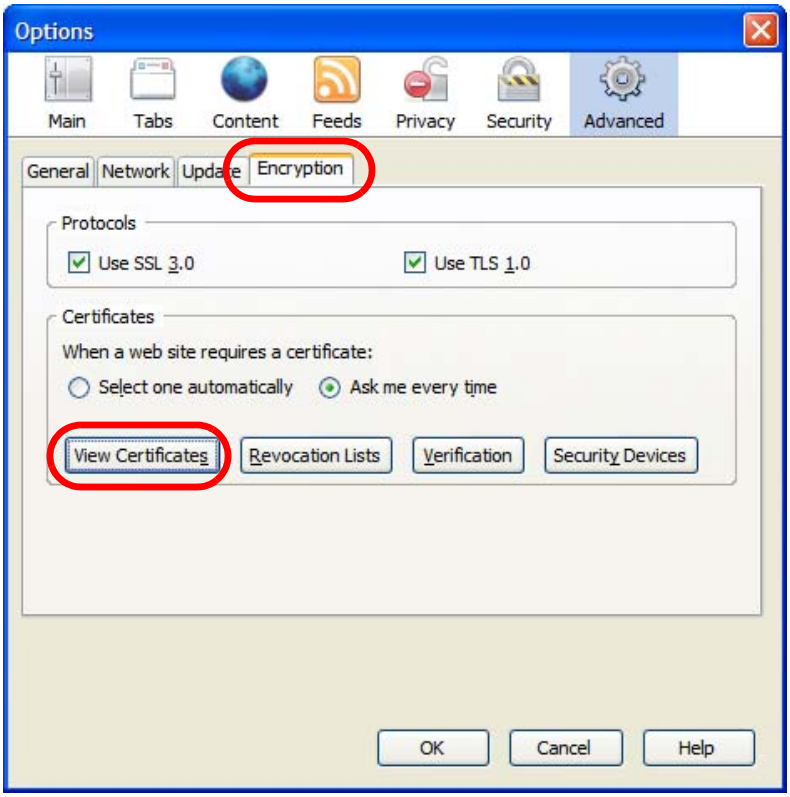
1 Open **Firefox** and click **TOOLS > Options**.

Figure 182 Firefox 2: Tools Menu



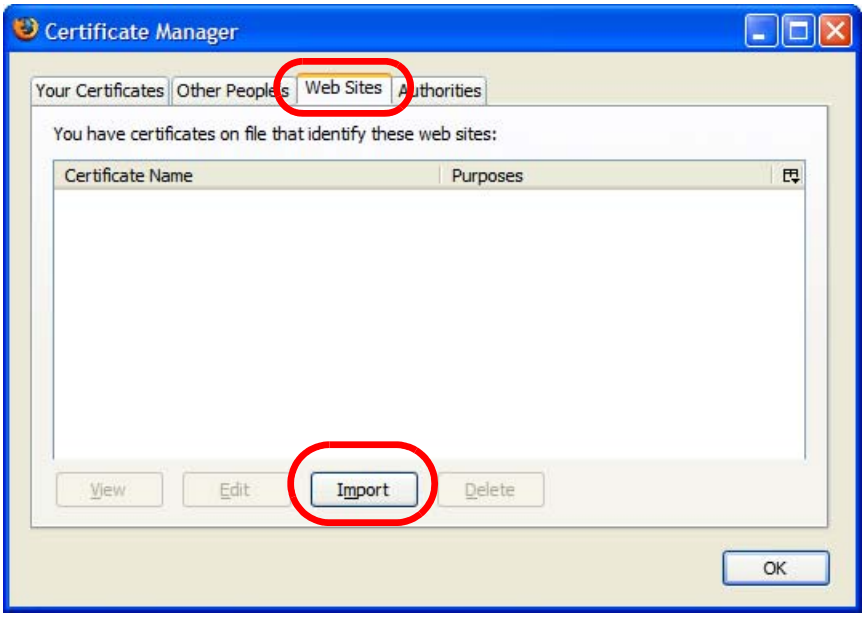
2 In the **Options** dialog box, click **ADVANCED > Encryption** > **View Certificates**.

Figure 183 Firefox 2: Options



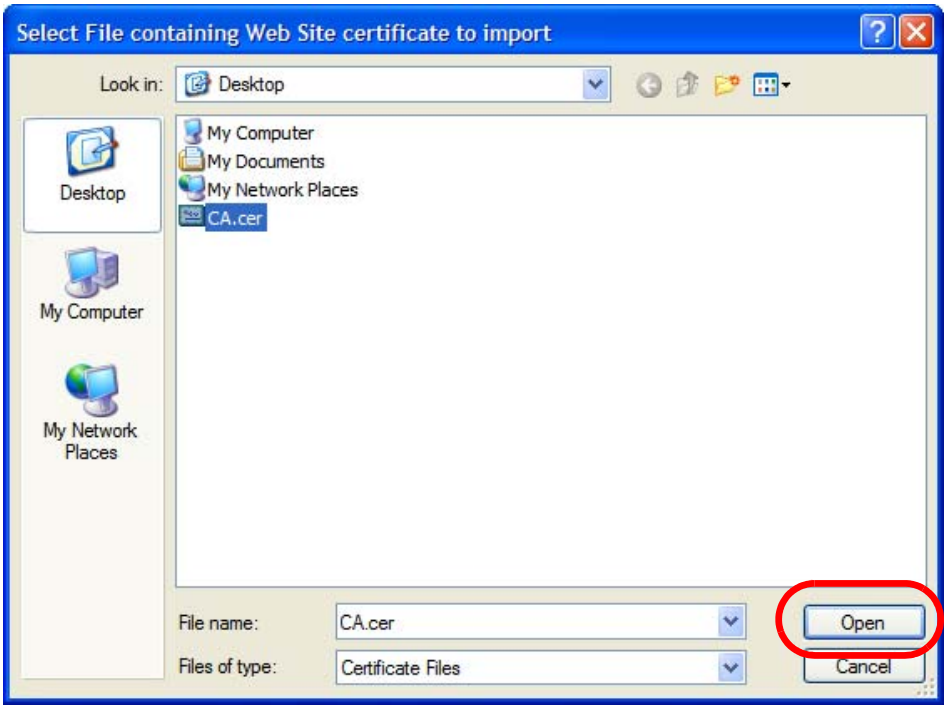
3 In the **Certificate Manager** dialog box, click **Web Sites** > **Import**.

Figure 184 Firefox 2: Certificate Manager



4 Use the **Select File** dialog box to locate the certificate and then click **Open**.

Figure 185 Firefox 2: Select File



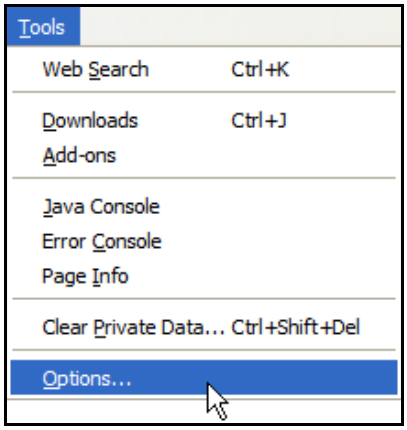
5 The next time you visit the web site, click the padlock in the address bar to open the **Page Info > Security** window to see the web page's security information.

Removing a Certificate in Firefox

This section shows you how to remove a public key certificate in Firefox 2.

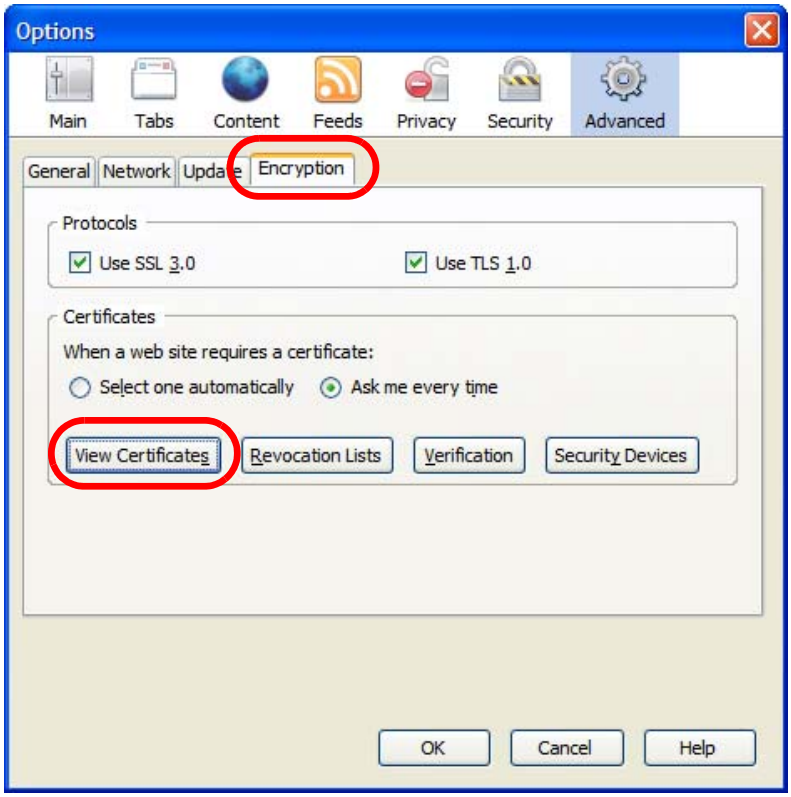
1 Open **Firefox** and click **TOOLS > Options**.

Figure 186 Firefox 2: Tools Menu



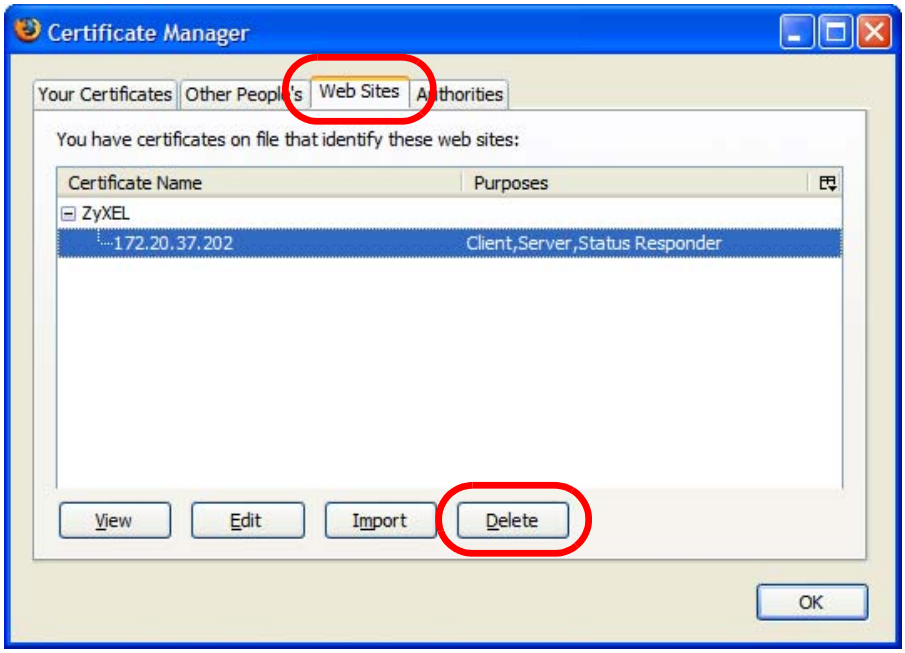
2 In the **Options** dialog box, click **ADVANCED > Encryption** > **View Certificates**.

Figure 187 Firefox 2: Options



3 In the **Certificate Manager** dialog box, select the **Web Sites** tab, select the certificate that you want to remove, and then click **Delete**.

Figure 188 Firefox 2: Certificate Manager



4 In the **Delete Web Site Certificates** dialog box, click **OK**.

Figure 189 Firefox 2: Delete Web Site Certificates

Delete Web Site Certificates
Are you sure you want to delete these web site certificates?
172.20.37.202
If you delete a web site certificate, you will be asked to accept it again the next time you visit the web site.
OK
Cancel

5 The next time you go to the web site that issued the public key certificate you just removed, a certification error appears.

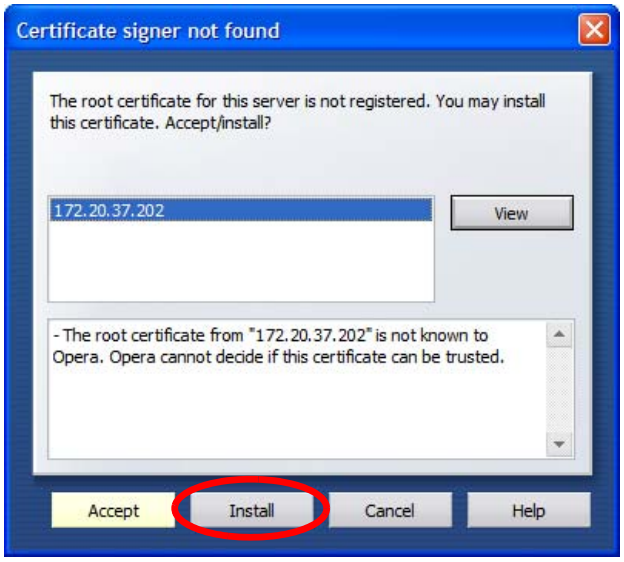
Opera

The following example uses Opera 9 on Windows XP Professional; however, the screens can apply to Opera 9 on all platforms.

1 If your device's web configurator is set to use SSL certification, then the first time you browse to it you are presented with a certification error.

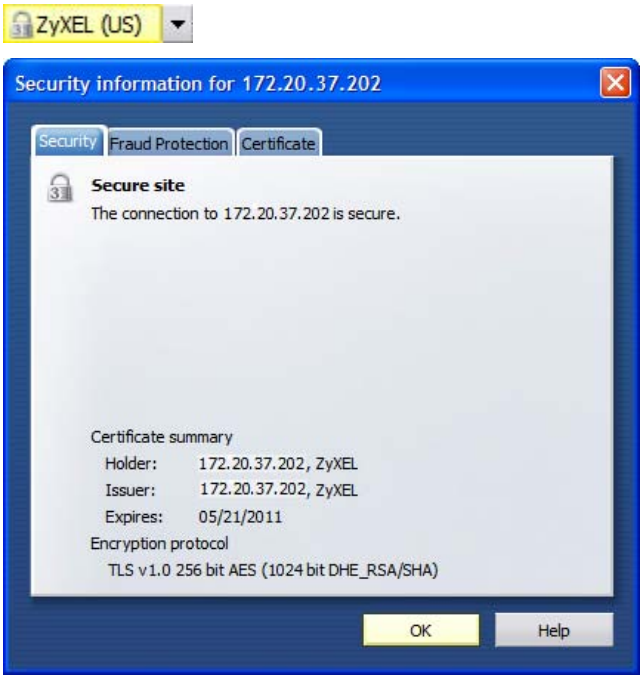
2 Click **Install** to accept the certificate.

Figure 190 Opera 9: Certificate signer not found


Certificate signer not found
The root certificate for this server is not registered. You may install this certificate. Accept/install?
172.20.37.202
View
- The root certificate from "172.20.37.202" is not known to Opera. Opera cannot decide if this certificate can be trusted.
Accept
Install
Cancel
Help

3 The next time you visit the web site, click the padlock in the address bar to open the **Security information** window to view the web page's security details.

Figure 191 Opera 9: Security information

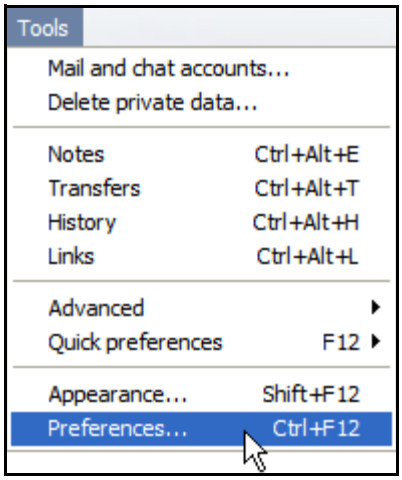


Installing a Stand-Alone Certificate File in Opera

Rather than browsing to a ZyXEL web configurator and installing a public key certificate when prompted, you can install a stand-alone certificate file if one has been issued to you.

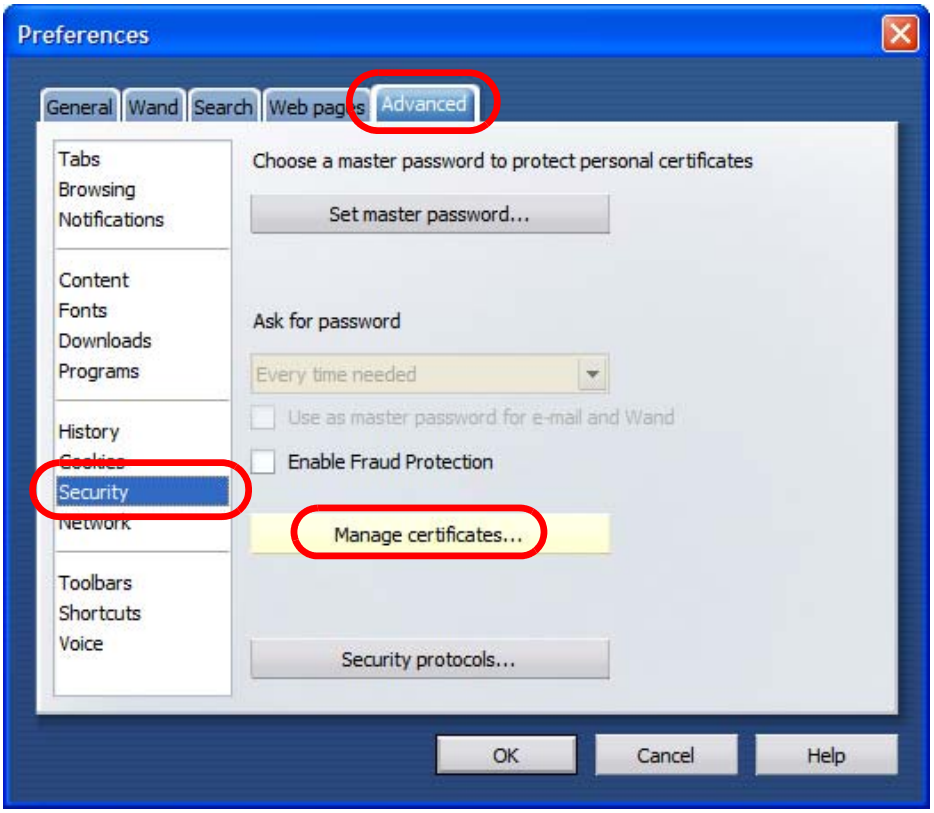
1 Open **Opera** and click **TOOLS > Preferences**.

Figure 192 Opera 9: Tools Menu



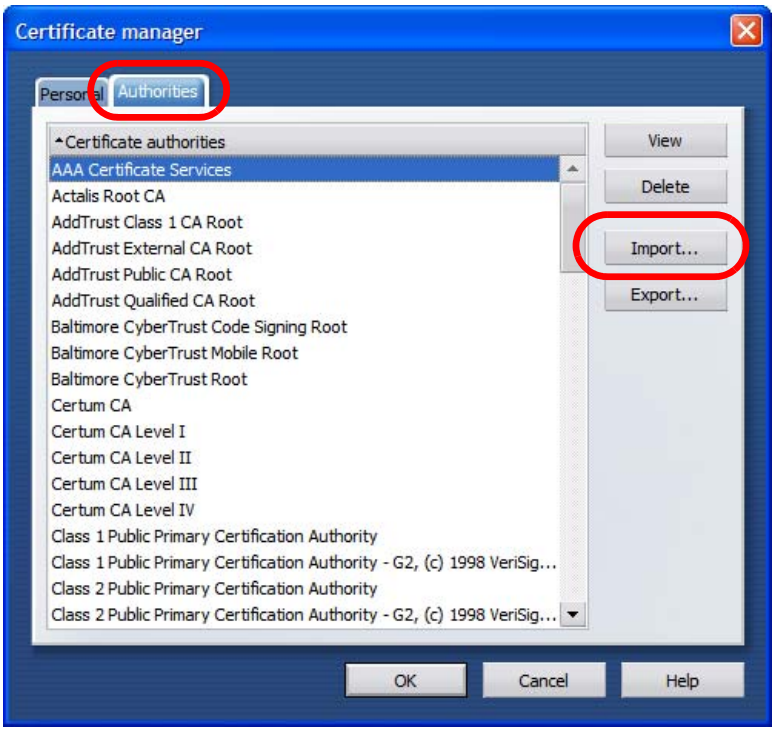
2 In **Preferences**, click **ADVANCED > Security** > **Manage certificates**.

Figure 193 Opera 9: Preferences



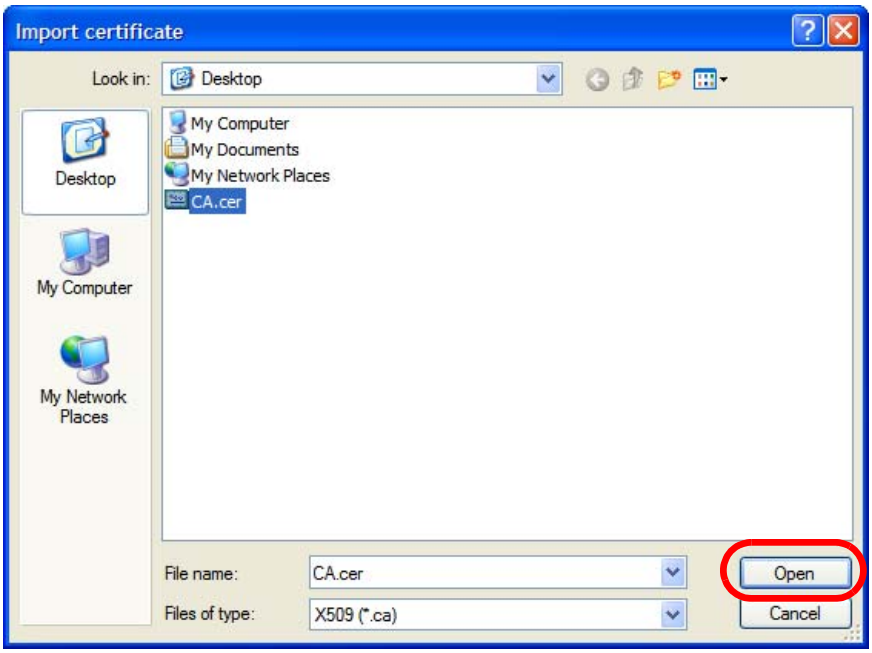
3 In the **Certificates Manager**, click **Authorities** > **Import**.

Figure 194 Opera 9: Certificate manager



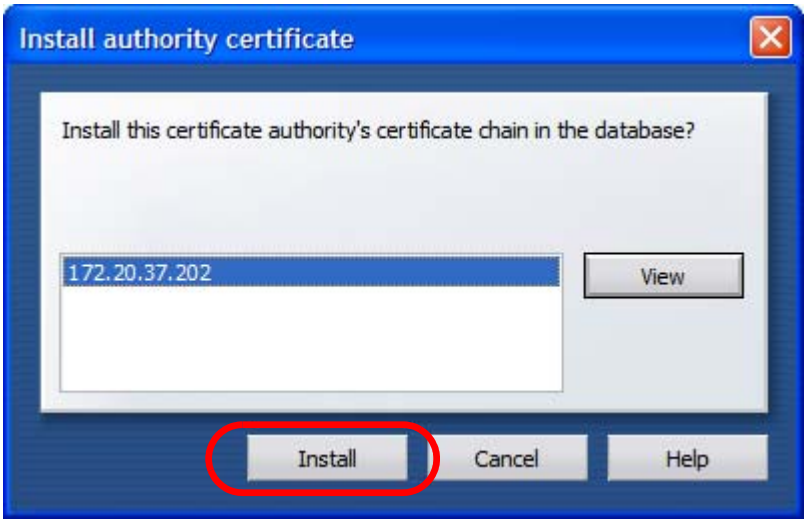
4 Use the **Import certificate** dialog box to locate the certificate and then click **Open.**

Figure 195 Opera 9: Import certificate



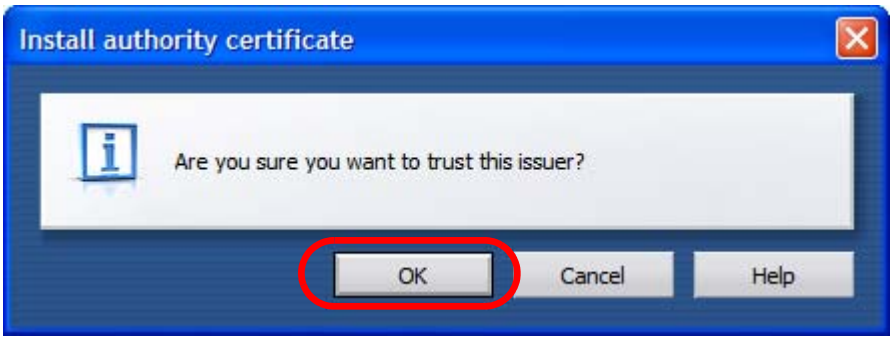
5 In the **Install authority certificate** dialog box, click **Install**.

Figure 196 Opera 9: Install authority certificate



6 Next, click **OK**.

Figure 197 Opera 9: Install authority certificate



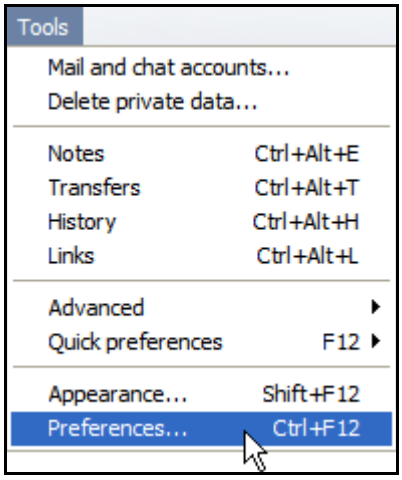
7 The next time you visit the web site, click the padlock in the address bar to open the **Security information** window to view the web page's security details.

Removing a Certificate in Opera

This section shows you how to remove a public key certificate in Opera 9.

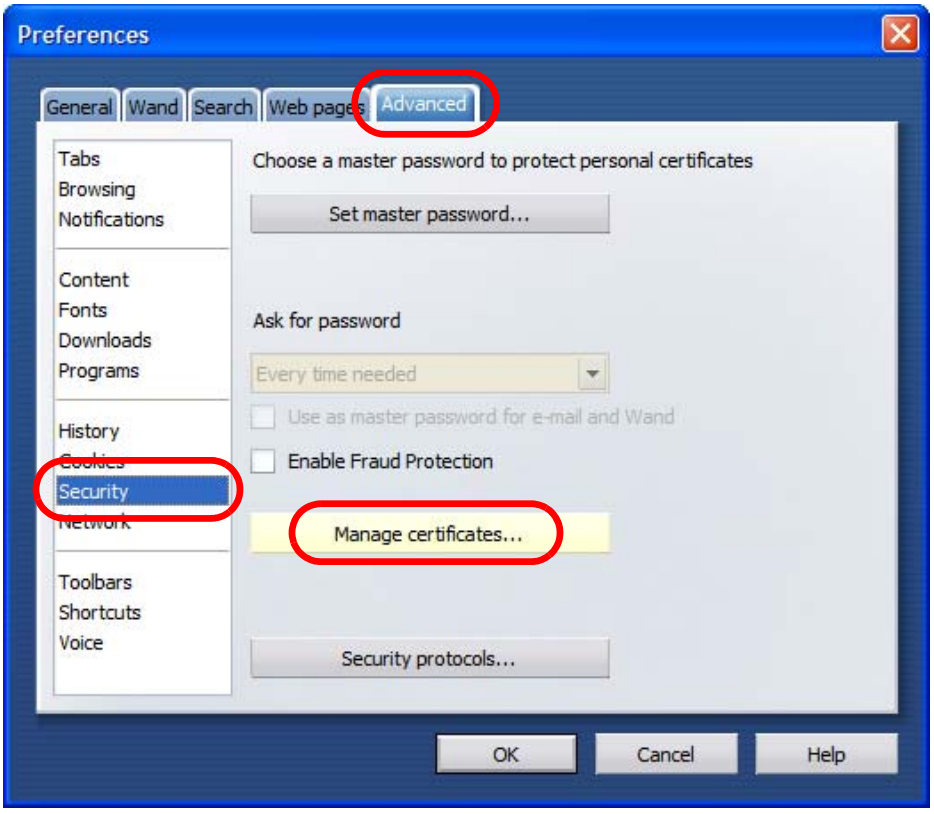
1 Open **Opera** and click **TOOLS > Preferences**.

Figure 198 Opera 9: Tools Menu



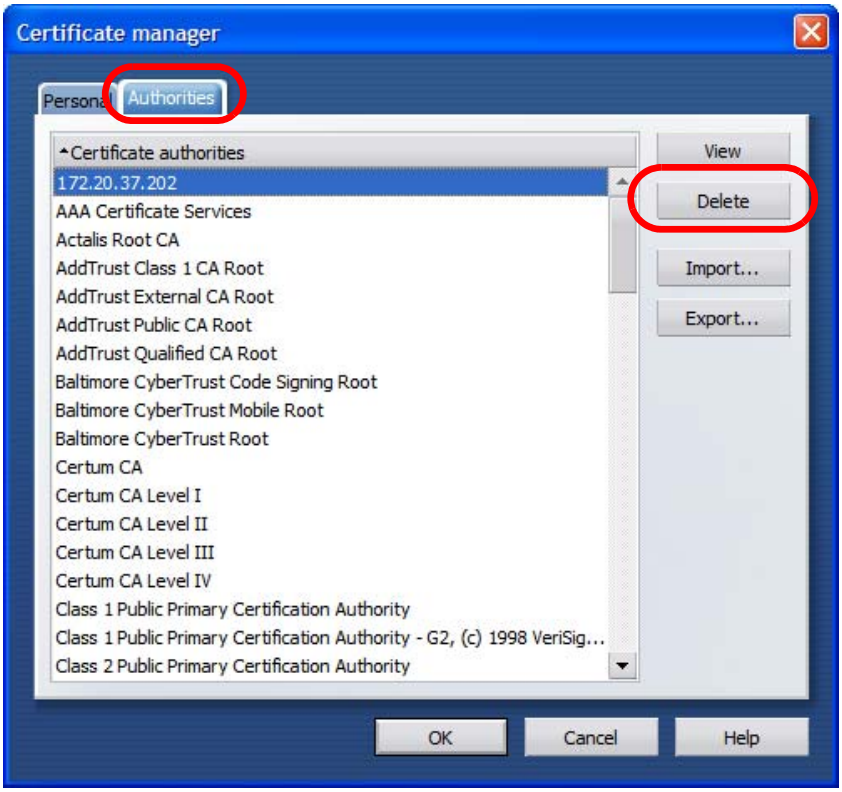
2 In **Preferences**, **ADVANCED > Security** > **Manage certificates**.

Figure 199 Opera 9: Preferences



3 In the **Certificates manager**, select the **Authorities** tab, select the certificate that you want to remove, and then click **Delete**.

Figure 200 Opera 9: Certificate manager



4 The next time you go to the web site that issued the public key certificate you just removed, a certification error appears.

Note: There is no confirmation when you delete a certificate authority, so be absolutely certain that you want to go through with it before clicking the button.

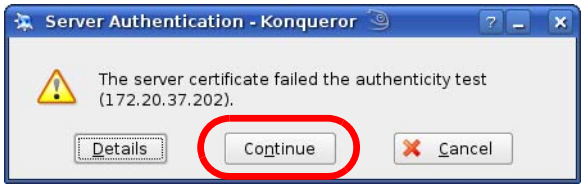
Konqueror

The following example uses Konqueror 3.5 on openSUSE 10.3, however the screens apply to Konqueror 3.5 on all Linux KDE distributions.

1 If your device's web configurator is set to use SSL certification, then the first time you browse to it you are presented with a certification error.

2 Click **Continue**.

Figure 201 Konqueror 3.5: Server Authentication



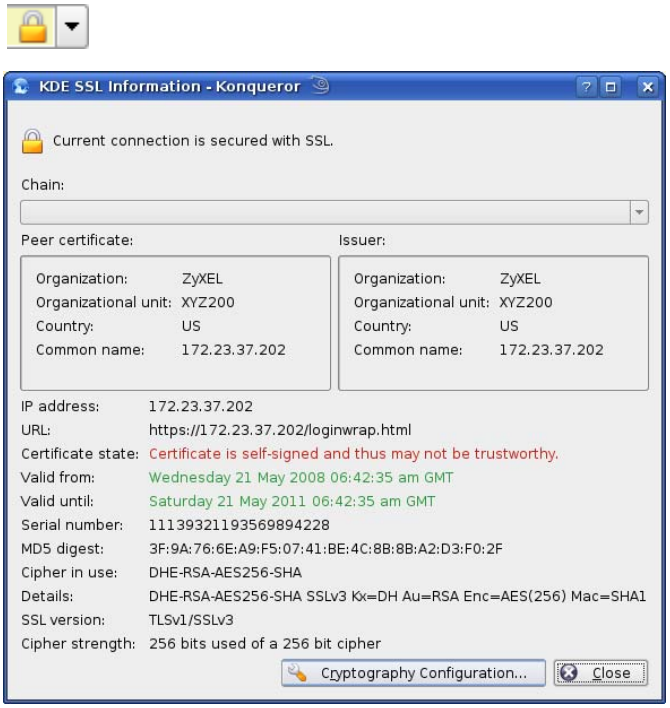
3 Click **Forever** when prompted to accept the certificate.

Figure 202 Konqueror 3.5: Server Authentication

Server Authentication - Konqueror
Would you like to accept this certificate forever without being prompted?
Forever
Current Sessions Only

4 Click the padlock in the address bar to open the **KDE SSL Information** window and view the web page's security details.

Figure 203 Konqueror 3.5: KDE SSL Information



Installing a Stand-Alone Certificate File in Konqueror

Rather than browsing to a ZyXEL web configurator and installing a public key certificate when prompted, you can install a stand-alone certificate file if one has been issued to you.

1 Double-click the public key certificate file.

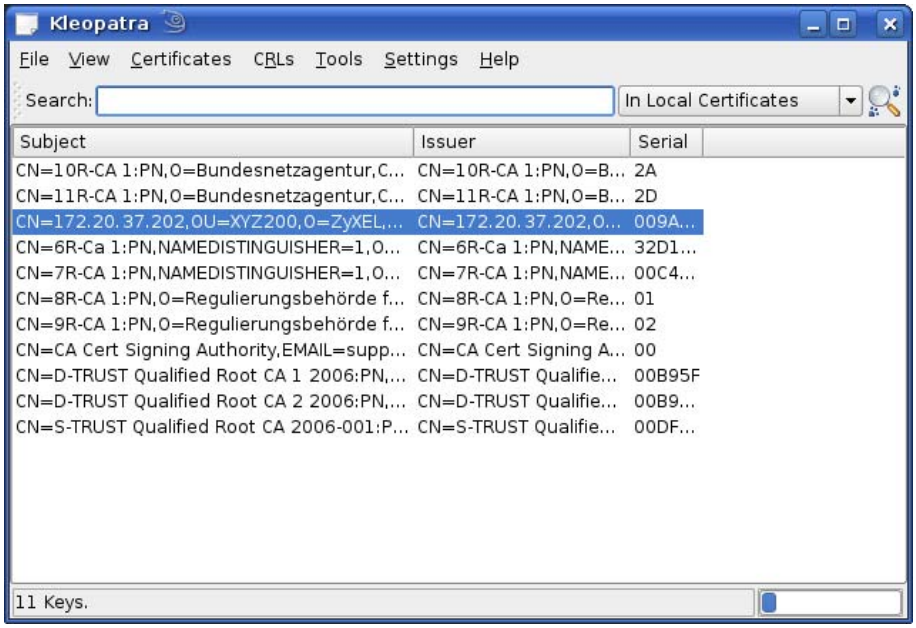
Figure 204 Konqueror 3.5: Public Key Certificate File

2 In the **Certificate Import Result - Kleopatra** dialog box, click **OK**.

Figure 205 Konqueror 3.5: Certificate Import Result

The public key certificate appears in the KDE certificate manager, **Kleopatra**.

Figure 206 Konqueror 3.5: Kleopatra


Kleopatra
File View Certificates CRLs Tools Settings Help
Search:
In Local Certificates
Subject Issuer Serial
CN=10R-CA 1:PN,O=Bundesnetzagentur,C... CN=10R-CA 1:PN,O=B... 2A
CN=11R-CA 1:PN,O=Bundesnetzagentur,C... CN=11R-CA 1:PN,O=B... 2D
CN=172.20.37.202,OU=XYZ200,O=ZyXEL,... CN=172.20.37.202,O... 009A...
CN=6R-Ca 1:PN,NAMEDISTINGUISHER=1,O... CN=6R-Ca 1:PN,NAME... 32D1...
CN=7R-CA 1:PN,NAMEDISTINGUISHER=1,O... CN=7R-CA 1:PN,NAME... 00C4...
CN=8R-CA 1:PN,O=Regulierungsbehörde f... CN=8R-CA 1:PN,O=Re... 01
CN=9R-CA 1:PN,O=Regulierungsbehörde f... CN=9R-CA 1:PN,O=Re... 02
CN=CA Cert Signing Authority,EMAIL=supp... CN=CA Cert Signing A... 00
CN=D-TRUST Qualified Root CA 1 2006:PN,... CN=D-TRUST Qualifie... 00B95F
CN=D-TRUST Qualified Root CA 2 2006:PN,... CN=D-TRUST Qualifie... 00B9...
CN=S-TRUST Qualified Root CA 2006-001:P... CN=S-TRUST Qualifie... 00DF...
11 Keys.

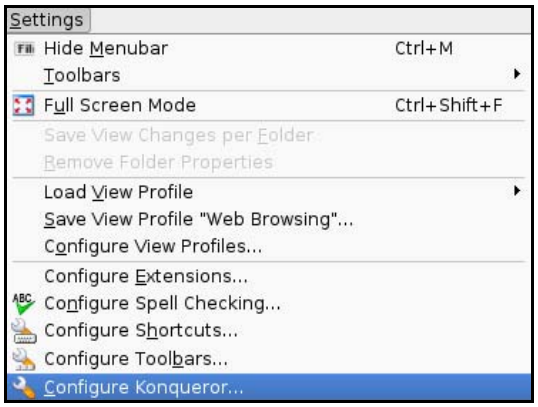
3 The next time you visit the web site, click the padlock in the address bar to open the **KDE SSL Information** window to view the web page's security details.

Removing a Certificate in Konqueror

This section shows you how to remove a public key certificate in Konqueror 3.5.

1 Open **Konqueror** and click **Settings > Configure Konqueror**.

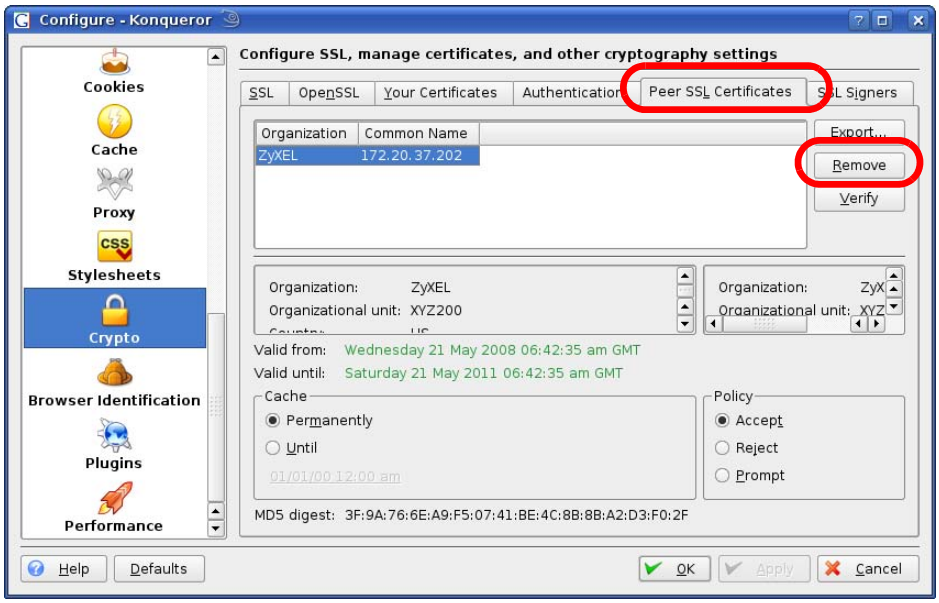
Figure 207 Konqueror 3.5: Settings Menu



2 In the **Configure** dialog box, select **Crypto**.

3 On the **Peer SSL Certificates** tab, select the certificate you want to delete and then click **Remove**.

Figure 208 Konqueror 3.5: Configure



4 The next time you go to the web site that issued the public key certificate you just removed, a certification error appears.

Note: There is no confirmation when you remove a certificate authority, so be absolutely certain you want to go through with it before clicking the button.

F

SIP Passthrough

Enabling/Disabling the SIP ALG

You can turn off the WiMAX Modem SIP ALG to avoid retranslating the IP address of an existing SIP device that is using STUN. If you want to use STUN with a SIP client device (a SIP phone or IP phone for example) behind the WiMAX Modem, use the `ip alg disable ALG_SIP` command to turn off the SIP ALG.

Signaling Session Timeout

Most SIP clients have an “expire” mechanism indicating the lifetime of signaling sessions. The SIP UA sends registration packets to the SIP server periodically and keeps the session alive in the WiMAX Modem.

If the SIP client does not have this mechanism and makes no call during the WiMAX Modem SIP timeout default (60 minutes), the WiMAX Modem SIP ALG drops any incoming calls after the timeout period. You can use the `ip alg siptimeout` command to change the timeout value.

Audio Session Timeout

If no voice packets go through the SIP ALG before the timeout period default (5 minutes) expires, the SIP ALG does not drop the call but blocks all voice traffic and deletes the audio session. You cannot hear anything and you will need to make a new call to continue your conversation.

G

Common Services

The following table lists some commonly-used services and their associated protocols and port numbers. For a comprehensive list of port numbers, ICMP type/code numbers and services, visit the IANA (Internet Assigned Number Authority) web site.

- **Name**: This is a short, descriptive name for the service. You can use this one or create a different one, if you like.
- **Protocol**: This is the type of IP protocol used by the service. If this is **TCP/UDP**, then the service uses the same port number with TCP and UDP. If this is **USER-DEFINED**, the **Port(s)** is the IP protocol number, not the port number.
- **Port(s)**: This value depends on the **Protocol**. Please refer to RFC 1700 for further information about port numbers.
  - If the **Protocol** is **TCP**, **UDP**, or **TCP/UDP**, this is the IP port number.
  - If the **Protocol** is **USER**, this is the IP protocol number.
- **Description**: This is a brief explanation of the applications that use this service or the situations in which this service is used.

Table 126 Commonly Used Services

NAME	PROTOCOL	PORT(S)	DESCRIPTION
AH (IPSEC_TUNNEL)	User-Defined	51	The IPSEC AH (Authentication Header) tunneling protocol uses this service.
AIM/New-ICQ	TCP	5190	AOL's Internet Messenger service. It is also used as a listening port by ICQ.
AUTH	TCP	113	Authentication protocol used by some servers.
BGP	TCP	179	Border Gateway Protocol.
BOOTP_CLIENT	UDP	68	DHCP Client.
BOOTP_SERVER	UDP	67	DHCP Server.
CU-SEEME	TCP UDP	7648 24032	A popular videoconferencing solution from White Pines Software.
DNS	TCP/UDP	53	Domain Name Server, a service that matches web names (for example www.zyxel.com) to IP numbers.

Table 126 Commonly Used Services (continued)

NAME	PROTOCOL	PORT(S)	DESCRIPTION
ESP (IPSEC_TUNNEL)	User-Defined	50	The IPSEC ESP (Encapsulation Security Protocol) tunneling protocol uses this service.
FINGER	TCP	79	Finger is a UNIX or Internet related command that can be used to find out if a user is logged on.
FTP	TCP TCP	20 21	File Transfer Program, a program to enable fast transfer of files, including large files that may not be possible by e-mail.
H.323	TCP	1720	NetMeeting uses this protocol.
HTTP	TCP	80	Hyper Text Transfer Protocol - a client/server protocol for the world wide web.
HTTPS	TCP	443	HTTPS is a secured http session often used in e-commerce.
ICMP	User-Defined	1	Internet Control Message Protocol is often used for diagnostic or routing purposes.
ICQ	UDP	4000	This is a popular Internet chat program.
IGMP (MULTICAST)	User-Defined	2	Internet Group Management Protocol is used when sending packets to a specific group of hosts.
IKE	UDP	500	The Internet Key Exchange algorithm is used for key distribution and management.
IRC	TCP/UDP	6667	This is another popular Internet chat program.
MSN Messenger	TCP	1863	Microsoft Networks' messenger service uses this protocol.
NEW-ICQ	TCP	5190	An Internet chat program.
NEWS	TCP	144	A protocol for news groups.
NFS	UDP	2049	Network File System - NFS is a client/server distributed file service that provides transparent file sharing for network environments.
NNTP	TCP	119	Network News Transport Protocol is the delivery mechanism for the USENET newsgroup service.
PING	User-Defined	1	Packet INternet Groper is a protocol that sends out ICMP echo requests to test whether or not a remote host is reachable.
POP3	TCP	110	Post Office Protocol version 3 lets a client computer get e-mail from a POP3 server through a temporary connection (TCP/IP or other).

Table 126 Commonly Used Services (continued)

NAME	PROTOCOL	PORT(S)	DESCRIPTION
PPTP	TCP	1723	Point-to-Point Tunneling Protocol enables secure transfer of data over public networks. This is the control channel.
PPTP_TUNNEL (GRE)	User-Defined	47	PPTP (Point-to-Point Tunneling Protocol) enables secure transfer of data over public networks. This is the data channel.
RCMD	TCP	512	Remote Command Service.
REAL_AUDIO	TCP	7070	A streaming audio service that enables real time sound over the web.
REXEC	TCP	514	Remote Execution Daemon.
RLOGIN	TCP	513	Remote Login.
RTELNET	TCP	107	Remote Telnet.
RTSP	TCP/UDP	554	The Real Time Streaming (media control) Protocol (RTSP) is a remote control for multimedia on the Internet.
SFTP	TCP	115	Simple File Transfer Protocol.
SMTP	TCP	25	Simple Mail Transfer Protocol is the message-exchange standard for the Internet. SMTP enables you to move messages from one e-mail server to another.
SNMP	TCP/UDP	161	Simple Network Management Program.
SNMP-TRAPS	TCP/UDP	162	Traps for use with the SNMP (RFC:1215).
SQL-NET	TCP	1521	Structured Query Language is an interface to access data on many different types of database systems, including mainframes, midrange systems, UNIX systems and network servers.
SSH	TCP/UDP	22	Secure Shell Remote Login Program.
STRM WORKS	UDP	1558	Stream Works Protocol.
SYSLOG	UDP	514	Syslog allows you to send system logs to a UNIX server.
TACACS	UDP	49	Login Host Protocol used for (Terminal Access Controller Access Control System).
TELNET	TCP	23	Telnet is the login and terminal emulation protocol common on the Internet and in UNIX environments. It operates over TCP/IP networks. Its primary function is to allow users to log into remote host systems.

Table 126 Commonly Used Services (continued)

NAME	PROTOCOL	PORT(S)	DESCRIPTION
TFTP	UDP	69	Trivial File Transfer Protocol is an Internet file transfer protocol similar to FTP, but uses the UDP (User Datagram Protocol) rather than TCP (Transmission Control Protocol).
VDOLIVE	TCP	7000	Another videoconferencing solution.

H

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This device has been tested and found to comply with the limits for a Class B digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This device generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

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3. Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
4. Consult the dealer or an experienced radio/TV technician for help.

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